73 magazine
for radio amateurs

$1.00
July 1973
26009

INSIDE THE WALKERGATE!

K1CLL REINVENTS THE VFO!
Latest developments on page 4

FLASH! GUS W4BPD IS NOT DEAD!
Confidential revelations on page 23

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K10ZS SOLVES IDENTITY CRISIS!
Graphic description starts on page 39

W6AGX EXPOSES CW PLOTS!
Sensational disclosures on page 65

NATIONWIDE PLANS MAPPED OUT!
Lurid details on page 50

73's HAM OF THE YEAR?

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73 magazine
for radio amateurs
#154 JULY 1973

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COVER: **Walker-Gate** */'wo-kar 'gāt/* **intransigent noun 1: a miniscule opening in the paperwork wall thrown up by A. Prose Walker to thwart repeater groups from providing lifesaving service throughout the country. Cover photo is of Walker telling Rochester hamfest banquet that amateur radio is, in his estimation, of little worth today. Hail to our Chief!**

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Amateur Radio

JULY MCMLXXIII Monthly Ham

WEATHER WATCH

The Ft. Worth Chapter of the Texas VHF-FM Society (amateur radio club) has operational in the Ft. Worth-Dallas area a network of approximately 200 trained weather observers. These amateur radio operators have attended the Skywarn spotters schools presented by the Ft. Worth-Tarrant County Office of Civil Defense and the Ft. Worth Office of the National Weather Service. After training is completed these radio operators are equipped with knowledge of weather situations that allow them to relay reliable information to the National Weather Service. They act as the "eyes" for this agency. When the National Weather Service issues a severe weather bulletin the Skywarn network is alerted and goes into operation under the Radio Amateur Civil Emergency Service (RACES) rules of the FCC. These alerts are keyed to the weather bulletin with a "Green Alert" for severe weather watch, a "Yellow Alert" for a severe weather warning and a "Red Alert" for a severe weather condition existing in the Ft. Worth-Dallas metropolitan area. Reporting for this network is accomlished via the WA5YTM repeater that is located on the KWXI-KTVT (standby) 1000 foot tower just north of the Ft. Worth terminal of the turnpike. The first hand weather information is relayed to the weather service through the amateur station located in the Emergency Operating Center at the Civil Defense Office. The volunteer amateurs, after receiving weather training, offer a highly sophisticated and reliable network of both communications and weather observers.

Alan Shawsmith VK4SS is an OT Brasspounder who collects Morse Keys – any type, age or condition, hand, 'bug,' novelty, etc. He is pictured here holding a miniature which is not a toy but a complete key used by the military. Alan's collection dates back 100 years and includes vintage overland telegraph 'pumps,' an assortment of 'bugs,' one or two novelties and a variety of keys used in the military services. VK4SS is an ex-PMG employer (B'casting pre-war 2). He has also been a ham for over 35 years and during this time pounded a variety of brass. He is keen to hear from anyone with a similar interest and to add to his collection, and will swap or buy anything in keys – ancient or modern, homebrew or commercial. Please write to 35 Whynot St., West End, Brisbane, Qld. 4101 Australia.

U.S. AMATEUR FREQUENCY ALLOCATIONS

	CW Only	Phone & CW
Extra Class	3.500– 3.775	3.775– 4.000
	7.000– 7.150	7.150– 7.300
	14.000–14.200	14.200–14.350
	21.000–21.250	21.250–21.450
	28.000–28.500	28.500–29.700
	50.000–50.100	50.100–54.000
Advanced Class	3.525– 3.775	3.800– 4.000
	7.025– 7.150	7.150– 7.300
	14.025–14.200	14.200–14.350
	21.025–21.250	21.270–21.450
	28.000–28.500	28.500–29.700
	50.000–50.100	50.100–54.000
General Class	3.525– 3.775	3.890– 4.000
	7.025– 7.150	7.225– 7.300
	14.025–14.200	14.275–14.350
	21.025–21.250	21.350–21.450
	28.000–28.500	28.500–29.700
		50.100–54.000
Novice Class	3.700– 3.750	
	7.100– 7.150	
	21.100–21.200	
	28.100–28.200	

SSTV Frequencies

	Suggested
3.775– 3.890	3.845
7.150– 7.225	7.220
14.200–14.275	14.230
21.250–21.350	21.340
28.500–29.700	28.680
50.100–54.000	

LICENSE FEES

Initial License	$ 9
Renewal	$ 9
New Class	$ 9
Modification	$ 4
Special Call Sign	$25

Use FCC Form 610 and mail with appropriate fee to:

Federal Communications Commission
Gettysburg PA 17325

CANADIAN RTTY NET

The Canadian Amateur Radio Teletype Group has inaugurated a national RTTY traffic net and bulletin service.

Operating on 14.08 MHz every Sunday at 1930 GMT with VE5KE as net control station, the CARTG will not only pass traffic but has received DOC permission to broadcast bulletins.

News Pages

FLOOD ASSISTANCE

The Moncton Transcript, Moncton, N.B. May 5, 1973. During the last weekend in April, two eastern New Brunswick amateurs spent 36 hours in the Fredericton area aiding armed forces personnel in rescuing people and livestock from the rapidly rising Saint John River.

They were among dozens of other hams from all over New Brunswick and Nova Scotia who participated in the coordination of rescue efforts through the use of mobile, portable and station radio equipment.

Early Sunday morning, Ron Hesler VE1SH, learned there was an urgent need for hand-held 2m transceivers in the stricken area.

He immediately volunteered his services and equipment. Getting in touch with Norman Roach VE1ACA in Moncton through the repeater VE1RPT of the Maritime VHF Association, Mr. Hesler arranged with him the organization of personnel and equipment in Moncton.

Mr. Hesler then immediately departed with his equipment for Moncton, where he picked up Reed Park VE1NU Moncton, on the Trans-Canada highway. Among the equipment procured by Mr. Roach for the trip were portable transceivers owned by Ray Hickey VE1SL; George Battis VE1AOH; and Bill Horton VE1WU.

Hesler and Park arrived in Frederickton in the latter part of Sunday afternoon.

As soon as they arrived, the two men were pressed into service as a communications link between relief boats and barges and the base station VE1AVA at the Emergency Measures Organization field headquarters, and they remained on the job throughout that night and the following day.

Liaison communications back to Moncton for relief operators, equipment and welfare messages were relayed to Mr. Roach through the amateur station of Al Breen VE1ANW, located on Mount Champlain.

Ron Hesler and Reed Park remained at their assigned posts with less than two hours sleep until late Monday afternoon, when they were relieved by two Moncton amateurs, Gary Capson VE1AHM and Don Comeau VE1WT, who arrived with three additional portable transceivers. Later that night, Fred Stevens VE1DK from Truro arrived with yet another portable transceiver.

Ron Hesler, Reed Park and Norman Roach were only three of the hundreds of volunteers who spent hours and even days without sleep, food or shelter to help those affected by the rising waters.

CB News

The FCC issued the following news release dated May 4, 1973:

In an 11-count indictment returned today by a Federal Grand Jury at Detroit, Mich., George Bennett of Detroit and the United CB'ers of America, a Michigan non-profit corporation of which Bennett is President, were charged with violating various provisions of the U.S. Code by distributing counterfeit radio station licenses purportedly issued by the Federal Communications Commission.

Additionally, the defendants are charged with making false statements to the FCC in an application for a license in the Citizens Radio Service.

The indictment further charges the defendants with a scheme intended to defraud members of the public and the Government of the United States. The indictment further alleged that the defendants' activities had interfered with and impeded the lawful regulatory functions of the Federal Communications Commission.

Bennett and the United CB'ers of America were also charged with violation of the mail fraud statute and conspiracy. Named as co-conspirators, but not as defendants, were: Art Dupon, Lucilie F. Mancinelli, Anthony R. Mancinelli, Joseph Goletz, Thomas Walton, Elmina C. Bennett, Joseph Smartt, Daniel DeLao, Mary Jean Hess, Ana P. Smith, Jerry C. Hopsen, A.B. Cole, Rosetta Aman, and Lohman Ballard.

By ARRL

REGS CALLED ASININE

Lew McCoy of the ARRL HQ Staff spoke up at the Dayton Hamvention to call the latest FCC regulations on repeaters "asinine." He further noted that as far as the ARRL can see we are only at the beginning of the troubles we will experience with destructive regulations.

The latest FCC pronouncements would seem to back up this evaluation

The recent virtual elimination of remote base operation and the limiting of control operators to six per repeater are just two more unbelievable jokes added to the others – all in bad taste.

This application of incredibly bad rules has not only hit the repeater groups. The phone ops got just as much of a jolt to their hopes for an orderly development when the recent new phone band allocations were announced – ditto the Novices. And so it goes, with each new regulation offending and damaging a new bunch of amateurs.

The troubles seem to stem entirely from A. Prose Walker, the Chief of the Citizens Band and Amateur Division of the FCC. There is more than one amateur who wishes that Mr. Walker would devote even a small part of his time to giving the CBers as much "progress" as he has the hams. With a little of his expert attention they would soon be off the air.

The motto sprang up at Dayton almost spontaneously among the over 500 repeater ops present at the FM meeting – "Prose Goes." McCoy indicated that the ARRL is doing everything in its power to see that Prose gets ousted.

EDITORIAL BY WAYNE GREEN

WALKER SPEAKS

The guest speaker at the Rochester Hamfest this year was A. Prose Walker, the chief of the citizens and amateur division of the FCC. Walker spoke before a full house at the hamfest banquet.

Walker had quite a lot to say to the crowded room full of amateurs. He explained that in his view amateur radio was no longer justifying itself – that appliance operators seemed to be in the overwhelming majority and that amateurs no longer were making significant contributions technically and that in the eyes of the Commission there was some question about the value of the amateur service.

He read off parts of the FCC rules pertaining to the reasons for amateur radio existing and indicated that in his opinion – and probably also in the opinion of the FCC commissioners – amateurs were not shaping up and we'd better do something about it.

Walker went on to extol the merits of the citizens band – and to point out the extreme difficulties they have to work under with only 22 channels for over 800,000 licensees and some 4,000,000 base and mobile stations licensed. A tear dropped down each amateur cheek – partly for the poor CBers and partly for Walker and his concern.

Walker pointed out that these chaps have over one billion dollars invested in their equipment.

How I would love to get Mr. Walker on a platform in a debate. I am sure that many amateurs sat there and listened with increasing fury to find that the top man in the Commission is so opinionated – and so terribly wrong! This is the man who has the ear of the seven Commissioners! Apparently this is the ONLY man who has their ear, for when you write to any of the Commissioners your answer comes back from Walker.

If Walker had not been too busy to attend the talk I gave earlier in the day he would have gotten some data which would have shot holes in his pet theory that amateurs are no longer making contributions technically. I cited chapter and verse on amateur development in the development of CW, of sideband, RTTY, and even FM! The involvement is deeper than most amateurs are aware – and obviously more than the Commission is aware.

Since this was a banquet speech, no one could jump up and point out the obvious fallacies in what Walker was saying. As one fellow said after the banquet, sure there are lots of CBers crammed onto 22 channels – but this is not the same as one million hams on 22 channels on 75 meters, as suggested by Walker. When you consider that a five watt CB rig normally has a range of just a few miles, under the best of circumstances, you see that there are several thousand separate cities and towns where CB can communicate. If you figure a 20-mile range for a CB rig you end up with about 15,000 such communities around the country. Let's say that we only consider 3000 of those – 22 channels per area – and 100 users per channel (a repeater with only 100 users is occupied only a few hours a day on the average and the range is ten times that of a clear CB channel) – you find that you can handle 6.6 million CBers . . . without any need for serious interference. Of course high power, beams, excessive use, and such would eat into that number – and it has – it has.

The one billion dollar investment story seems to be Walker's answer to suggestions about eliminating 27 MHz CB. May I remind Walker that there is good and adequate precedent to make a small change in this band which could cure the problem – and not interfere with the billion investment. Remember that not long ago amateurs were forced to either upgrade their licenses or else move out of the bands they had been using – and I don't recall any concern over the amateur investment involved. General licensees were forced out of the choicest parts of the phone bands, right across the board.

Suppose the Commission decided to change 27 MHz back into an amateur band – perhaps a Novice Class band with the simple Novice technical and code exam? Upgrade or get out would be the message – just as the Commission told the amateurs. No loss in investment – even a seven year old child can get a Novice license. The one billion dollars is protected.

The manufacturers could be gotten behind this scheme by getting the power limit raised to one kilowatt – VFO operation anywhere within the band – etc. They could quickly sell another billion dollars worth of hardware.

To those few readers who tend to take all of my suggestions seriously, may I point out that sometimes I am just being sarcastic. In this case I hope that you realize the above suggestion was not seriously tendered. I don't think the FCC has the guts to make any change in 27 MHz. That's a rough bunch down there on eleven and they can set up a squawk in Washington and via the EIA lobby that the Commission will avoid at all costs. The FCC doesn't like congressmen calling up with complaints.

Now, about those appliance operators. Immediately after the Walker speech, the Rochester club gave out awards to a number of amateurs who had performed outstanding service during the recent floods – including a plaque to one of the top amateurs. Sure, we talk a lot on the air – but when we're needed we are there. A show of hands was asked for – how many here have two meter FM mobile? Over half of those present raised a hand. How many have been involved in a serious emergency in which amateur radio has helped – almost the same number of hands. A lot of us may buy rigs and spend a good part of our declining years putting out hot air on the ham bands – but most of us are right in there when we are needed – and by virtue of the equipment we use for gassing we can do a bang-up job when the chips are down. My hand unit has only saved a life once – but how many times is enough? Even if nine out of ten hams are never needed – it still is enough.

And about that building – while not many of us build our transmitters – there are more counters and synthesizers being built in hamshacks today than transmitters in the 30's. There are more builders today – not only in number, but in percentage, if you count the innovative builders and discount the kit assemblers (which is about what building was like in the 30's – and I was there).

Continued on page 16

REPEATERBILITY

by Standard Communications

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SSTV SCENE

Dave Ingram K4TWJ
Rte. 11, Box 499, Eastwood Vil. 50N
Birmingham AL 35210

A frequently raised subject among Slow Scanners is how fairly weak signals often produce good pictures, while occasionally a picture cannot be obtained from a reasonably strong and clear signal. Reports of this have been received from all over the world, and from owners of every type of Slow Scan gear. There are two possible causes of this phenomenon. The first and most common is sync cancellation due to multipath propagation. If the two signals received at your QTH (two instead of one due to the multipath propagation) are out of phase, they will cancel. Further, if this multipath "loss" is only around 1200 Hz, only sync pulses will be lost (thus no picture), but the signal will still sound like a good Slow Scan signal. Should you look at the signal right out of the receiver's i-f with a spectrum analyzer, you could see the sync is nonexistent. There is no simple solution to multipath lost sync. Fortunately, however, the problem is not encountered too often; thus we can live with it (also, later in the sunspot cycle it will be less noticeable).

The second cause is limiter "latch up." Most solid state monitors use either a 709 or 741 op-amp in their "front end" in a limiter configuration. Should latch up occur, no output will be obtained from this stage. The solution is simple: Drop the Slow Scan input level to the monitor, the limiter operates again, and the picture appears (assuming latch up is the problem – remember, multipath propagation is the more likely cause).

Word is just in from Franta OK1OO, who writes the SSTV column for *Amateurski Radio*, that 40 or 50 Czechoslovakian hams are building monitors, and about 10 are already listening and watching. We should be hearing quite a bit from them in the near future. Also, they are quite interested in the direct fast to slow scan conversion technique, probably due to the scarcity of plumbicons there. Their monitor circuits are very modern and elaborate. For example, phase locked loop IC and magnetically deflected electrostatically focused CRT are becoming common.

Wayne W2NSD/1 recently brought up an idea which could further Slow Scan popularity worldwide if successfully initiated. He suggests starting some tape services to help chaps with only monitors to get on the air. Robot proved this point a while back, when they made tapes for new monitor owners. The results proved successful, as most of these fellows now have their own Slow Scan picture generating gear. How about some taping volunteers? If you would like to help, let me know (and whether or not you plan to charge for the "tape service"... although I will not mention exact prices). I will run a SSTV tape service list in 73 if this pans out.

This year's Dayton blast was the greatest yet. W4TB introduced his "Trix Box," which is capable of numerous low Scan special effects including special "wipes," video inversion on every other line, mixing black and white lettering on white and black backgrounds, "checkerboard" effects, etc. Although Bob Suding WØLMD couldn't make it, he sent a wealth of handout information on his projects. These included a SSTV sync generator with a frame time elapse readout and automatic tape recorder start/stop control, quite a few thoughts on Scan conversion (both fast to Slow and Slow to fast) plus info on his direct Fast to Slow Scan converter, (that proverbial "black box"... in goes a fast Scan TV signal and out comes a Slow Scan TV signal), plasma panels – replace your CRT with these 1/4 million neon bulb panels for a "super picture" – a SSTV keyboard for typing messages across the screen, and much more.

Cop McDonald presented a superb program on using Slow Scan communications as a modern bridge over (our world's) troubled waters – truly meaningful communication rather than just as an expensive toy. Ralph Taggart displayed his monitor (article on it coming up in 73) which, with the flip of a switch also displays a video analysis of the received signal. Very nice! Don Miller had his Slow to Fast scan converter (its heart is a single ended storage vidicon) feeding a regular television, and K4JPE brought a storage tube monitor.

Naturally all the Slow Scan manufacturers were there with their new gear... Fast scan monitors, nice cabinets, low light cameras, etc. I will go into detail on all the previously mentioned items within the next few months.

However, one item of immediate concern is STTV frequencies. In order to alleviate the present crowding on 20 meters, plans were made to move the Slow Scan net to 14.240 kHz. This should give more room (even ±10 kHz of 14.240 is better than everyone congregating on just 14.230) plus less QRM. Also, remember Slow Scan activity is not confined to only specific frequencies... it can be run anywhere in the Advanced class bands (80 – 15 meters). Let's get away from the .230 syndrome and start occupying the .230 to .250 region... and for Pete's sake, don't QRM the net! Move off frequency! It's legal. When will the net change occur? Maybe by mid-July, depending on worldwide notification. If you don't hear the net on .230 next time, check .240 (and this column next month). Also, many of the fellows, especially the west coast, are having problems with the trash on 40 meters, thus a new frequency of 7171 kHz has been chosen. Let's see more use of this choice band, especially now while the sunspot cycle is against us. Remember, we can use 7150 to 7225 kHz for Slow Scan, so don't just sit on 7171 and wait for a clear frequency.

K4TWJ

AMSAT NEWS

Michael Frye WB8LBP
640 Deauville Dr.
Dayton OH 45429

Orbit	Date (July)	Time (GMT)	Longitude of Eq. Crossing °W
3235	1	0036.9	56.6
3248	2	0131.8	70.4
3260	3	0031.7	55.4
3273	4	0126.7	69.1
3285	5	0026.6	54.1
3298	6	0121.5	67.8
3310	7	0021.5	67.8
3323	8	0116.4	66.5
3335	9	0016.9	51.5
3348	10	0111.3	65.2
3360	11	0011.2	50.2
3373	12	0106.1	64.0
3385	13	0006.0	48.9
3398	14	0101.0	62.7
3410	15	0000.9	47.7
3423	16	0055.8	61.4
3436	17	0150.8	75.1
3448	18	0060.7	60.1
3461	19	0145.6	73.8
3473	20	0045.6	58.8
3486	21	0140.5	72.5
3498	22	0040.4	57.5
3511	23	0135.3	71.3
3523	24	0035.3	56.2
3536	25	0130.2	70.0
3548	26	0030.1	55.0
3561	27	0125.1	68.7
3573	28	0025.0	53.7
3586	29	0119.9	67.4
3598	30	0019.9	52.4
3611	31	0114.8	66.1

The really new item is that the OSCAR 6 schedule has finally been stabilized. The new schedule will allow enough air time to be useful and it will allow time for the onboard batteries to recharge.

OSCAR 6 ON-TIMES

Thursday	0000–2359 GMT
Saturday	0000–2359 GMT
Monday	0000–2359 GMT

On all other days the satellite will be off the air for regular traffic. Should you hear the satellite, please do not try to use it. Members of AMSAT are conducting tests and gathering telemetry for future use in trying to determine exactly what the overheating problem is. Certain stations have been designated as "Satellite Official Bulletin Stations," one of these being W3TMZ. Their purpose is to tell anyone trying to use the satellite on its off times of the new schedule and to ask them to please leave the air.

The satellite appears to be stabilizing with regard to battery drain and high temperatures that have been experienced recently. The new schedule is designed to provide a more lasting charge to the batteries and prevent them from discharging until they are dangerously low.

OSCAR 6 Telemetry Data

Chan.	Parameter	Unit
1A	Total Array	I (mA)
1B	+X Solar Panel	I (mA)
1C	-X Solar Panel	I (mA)
1D	+Y Solar Panel	I (mA)
2A	-Y Solar Panel	I (mA)
2B	+Z Solar Panel	I (mA)
2C	-Z Solar Panel	I (mA)
2D	Bat. Charge or Discharge	I (mA)
3A	Unregulated Bus	V
3B	½ Battery	V
3C	Switching Reg.	V
3D	Battery Temp.	°C
4A	Baseplate Temp.	°C
4B	Transponder P.A. Temp	°C
4C	+X Panel Temp.	°C
4D	+Y Panel Temp.	°C
5A	+Z Panel Temp.	°C
5B	Transp. P.A. Emitter	I (mA)
5C	Transp. Sw. Reg.	V
5D	Instr. Sw. Reg.	I (mA)
6A	Transponder rf Power	mW
6B	Beacon rf Power (435.1 MHz)	mW
6C	Transponder agc	V
6D	Midrange Cal.	V

From the net on Monday nights at 9:00 EDT, I have learned of the forming of a much-needed western net. Amateurs in New Mexico and surrounding states have had problems hearing the net and I hope that those who have the information and the capabilities will mold one together.

Included is a partial chart of OSCAR 6 telemetry. Stations that have telemetry-gathering capabilities please send your reports to AMSAT Telemetry Dept., P.O. Box 27, Washington DC 20044. Many stations are needed to help with this. If you have the capabilities or would like to try, send a letter to me along with SASE and I will send you complete information.

Next month I will present a special section on OSCAR mobiling and plans for OSCAR 7.

. . .WB8LBP

50 MHz BAND

Bill Turner WAØABI
Five Chestnut Court
St. Peters MO 63376

Jess WB4ZUO would like to let everyone know he will be monitoring 50.150 SSB from 2300 to 2330Z on a daily basis. I am sure Jess would also be happy to make schedules – you may write him at Route #2, West Green, Georgia 31567.

I attended the Dayton Hamvention and the associated technical seminars. The VHF seminar featured K2TXB, DL3WR, DJØBQ/G3JVQ and W8KPY. While not strictly a 6 meter affair, it was interesting, informative and a most pleasant way of meeting a number of you. There were several pieces of new 6 meter gear on display. Regency was showing the HR-6 FM transceiver; Genave, not to be outdone, was showing their new GTX-600, and Linear Systems featured the new SB-50 AM and SSB transceiver.

Happened across several of the 6 meter crowd on the display floor – Wayne K8LEE was there as was Bob WA8PEB. Met WB8JHT at the flea market and saw Frank K9HMB in the Imperial House. *73* was represented by Wayne and Keith . . . hope to see you there next year.

Didn't attend the West Coast VHF/UHF Conference? Here are some of the things we missed: Power transistors for VHF/UHF – W6FIG, Solid State Receivers – W6FZJ, 50 MHz Propagation – W6ABN, EME (50 MHz) – W7FN. Sorry I couldn't make it.

Art WA1EXN comments that the April 1st aurora started around 1800 in Maine and lasted about 4½ hours. Contacts were made as far south as N.C. (K4LWZ) and audio quality was excellent with signals ranging from 5/5 to 10/9. Over the period mentioned the band was open to the 2nd, 3rd, 4th, 8th and 9th call areas. Art worked K8BBN for the first time on April 8th – they had been trying to make a CW scatter contact all winter. Maine had its first Es opening of the year on April 20th with 20/9 signals from Georgia, Alabama and Florida. As is usual for early season openings, not many stations were active.

Art passes along a hint which is sure to be of interest to the many owners of Heath SB series gear: "Many operators have had problems with the alc refusing to work or working only intermittently . . . on investigation I found that the pot used to control the voltage for alc action had three short bronze pieces eyeletted to the aluminum connectors for ease of soldering the pot to the circuit board. When the two dissimilar metals are placed in contact with each other, oxidation occurs to such proportions as to cause intermittent alc action. This can be circumvented by bridging solder across the dissimilar metals or by substituting a good grade encapsulated pot in the board from the top for ease of adjustment. I passed this to W1ELP who in turn passed it to 10 operators of Heath equipment . . . of the 10, it cured 8."

As always, we need your reports of activity, your comments, answers to technical problems you have solved – and in fact anything which would be of interest to other active 6 meter amateurs. If you have a local net going, let me know. If you make an unusual contact, drop me a line – others are interested in activity in your area. If you have a question about equipment, activity, a rig problem, just ask. If I don't have the answer, someone among the readership will. If you have a TVI problem, a SASE will bring you a few hints on how to cure it, along with a list of manufacturers who provide high pass filters free or for a token sum.

How would you like a new all solid state station running 120W PEP output and available NOW from commercial sources? Details next month. Also next month some very interesting comments on 6 meter activity in Australia from Geoff VK3AMK.

. . .WAØABI

KQR DMQOU UKDU WTUPUPQZ,

RKTZ PF IQOY BSOM FTZGPZJ

PU?

BY: Gus M. Browning, W4BPD
Drawer "DX"
Cordova, S.C. 29039

I wonder how many of you have ever been to the Dayton (Ohio) Hamvention ? This year it was the biggest ever, so they told me. The attendance was something around 6,400 and I can tell you that when you get that many hams together, you have the darndest time, shaking hands, slapping backs, yelling, Hello Ole Buddy, and an awful lot of other shenanigans. Peggy and I drove our Mustang to the Hamvention loaded up to the brim with printed matter, QSL samples, etc. Everything we brought with us was all given out in the first 4 hours Saturday morning. We could have passed out well over twice that many without any trouble. I tried to visit every display and spent well over two hours and only got to see about half of them. Wayne Green was as busy as a cat on a tin roof selling 73 magazines like they were going out of style ! At the price he was selling subscriptions (only $ 3.00) may have had something to do with the mad rush of business at the 73 magazine booth. Wayne looked like a Harvard professor with those reading glasses (the upper part missing). There was so many DX'ers there that you couldn't stir them with a stick ! The DX forum room was full of them. Stu Meyer, W2GHK did a very good job acting as MC for the entire forum. Two of the gang that went to Spratley Island were there with some very fine pictures of the entire trip. Sure did make my feet itch seeing them and their troubles getting there (3 trials, the last one a success.) The only thing on the island (before they got there) was a few million birds and so they say, the birds did a little "dumping". I suppose the birds didn't like intruders on their private island. It's a pity we cant hire these birds to do the same to intruders on our ham bands ! Also present was the fellows that went to Juan Fernandez, St Felix and a few other islands. Many fine pictures and even movies was shown, all very interesting and making a fellow (like me) want to be on the other end of a big "pile-up" again, the sooner the better. A lot of talk about maybe another big DX organization being formed one of these days, with by-laws that would make the books wide open to everyone, all the time, maybe some kind of an award for working "DX", etc. You may (or may not) hear more about this as things progress or again all the talk may be "day-dreams" by a few fellows that is hoping to put some new life blood in the art of DXing. Lets all hope for the best, because if its good for DX, its good for all of us. At the present time there are too many right up to the top in the DXCC and I guess we need something more or less new to get everyone again interested in DXing. Lets wait and see what develops (if anything at all.)

So far our 73-73-73 certificate has been earned by the following fellows: (in the order as listed):

No. 1	W4NJF
No. 2	ZM1AMN
No. 3	W5NQR
No. 4	K4CKA
No. 5	W2GA
No. 6	WB6JQP
No. 7	ZM1AMM
No. 8	K2HWF
No. 9	K6ILM
No. 10	W2PMK
No. 11	K4TWJ
No. 12	PAØALO
No. 13	ZL2GJ
No. 14	VK6CH
No. 15	WA8UUY
No. 16	W8JFD
No. 17	W5BPT/3
No. 18	DK1YG
No. 19	W3JZJ/8
No. 20	WA2EJS
No. 21	5W1AU
No. 22	VK2BJL
No. 23	WBØHPL

This is not too bad, but we have a number of certificates on hand that we will mail out to those of you who qualify by having worked 73 countries in the first 73 days of 1973. Send me a list, showing the stations you worked, the country, etc. Have your list certified by 3 hams or your clubs secretary. KEEP IN MIND this is a ONE TIME CERTIFICATE, you get it now or you NEVER GET IT. Please send along $ 1.00 to partly cover our costs and I will do the rest. All WTW (Worked The World) certificates will have been mailed a month or so before you are reading this. The backlog of certificates work has now been caught up and I am QRX for anyone who has worked their 100 or more countries. We need a copy of your countries alphabetically arranged BY PREFIXES, showing dates, bands, mode used and name of country, also certified as above along with the $ 1.00. DO NOT SEND ME YOUR CARDS if you can have them certified. Your QSL cards should be on hand for this one and they should be certified. MOUNT ATHOS: I hope those of you who needed this NEW ONE had a QSO with the recent DXpedition to this spot. I had a number of fellows complaining that they never had a chance to work them due to what SEEMED to be caused by lack of activity. This seems hard to believe when you consider that TEN fellows was on the DXpedition to this rare country. I can assure you, that as far as I know this has not ever happened to me when I was on the other end on a DXpedition, and I AM ONLY ONE PERSON, without 9 others to "assist" me ! I am not saying who is at fault, I only pass on what was told to me. I wonder what some of you "out there" think about this ?

Please keep me in mind when you come across any DX news that I can use, but keep in mind that I have 60+ days date line. I need particularly news of any upcoming events,most certainly news of any DXpedition planned somewhat in the future and I always need news that is not "dated" Naturally I can always use your comments and suggestions to improve this column in this magazine, as long as they are of interest to other DXers.

QSL INFO:

1S1A - (Spratley Island via W1YRC

SV1DB/A - Mt. Athos via
SV1DB - Constantine Psiloyannes,
P.O. Box 1442, Athens, Greece

YK1OK: via Jenda Bubenicek
Box 35, Damascus, Syria

HB - Switzerland, worlds highest DX percentage country ! Thats right, according to a note I received from HB9J which says: If you will add up all the countries they have worked and divide this number by the number of hams in Switzerland you will have a higher number than any country in the world. I have took the word of HB9J that this is true, but it would be interesting to see some actual numbers to be 100% convinced. hi.

If you really want to work a LOT of countries try this: When you have received a card from any certain country DO NOT EVER WORK THAT COUNTRY AGAIN. Use your time LISTENING FOR NEW COUNTRIES. If nothing new is on spend that time LISTENING AND LISTENING !

A FEW DXING SUGGESTIONS:

1. Do not ever call the DX station on the exact frequency the last station was on if its a split frequency deal, remember that many, many other stations are doing the same thing.
2. Make your calls short, he knows his call GIVE HIM YOURS. be sure you use STANDARD PHONETICS.
3. Obey HIS INSTRUCTIONS, he is running the show NOT YOU.
4. Listen for a while and see how he SEEMS to be tuning, and select a frequency YOU THINK he will be tuning to. (Out guess the gang on this.)
5. DO NOT start anything like rag-chewing, giving your "handle", or QTH, etc. NOT UNLESS he indicates that this is what he wants from you. DO NOT BE A DX HOG !

73 es DX, de Gus W4BPD

A. PROSE WALKER

An Appreciation

by Keith Lamonica W7DXX/1

Although I am not from Missouri I do like to give people the benefit of the doubt. As you may know I have been active on FM for many years. In fact, I put up one of the first repeaters when that era was just starting. I enjoy VHF, FM and repeaters. I enjoy the challenge of experimentation in one of the newest areas of our hobby. Oh, I like operating 20 CW and Slow Scan but the potential of VHF repeaters excites me. I get a little bored on the lower bands – not so on VHF. There are still so many areas of experimentation.

I remember well two meters prior to Docket 18803. We were having a few growing pains, but on the whole the situation was not bad at all. What problems we were having were being ironed out quite nicely by individual repeater owners or repeater councils. As I recall, most of us were simply asking for FCC recognition of FM, the clarification of certain FCC rules and the implementation of a few new regulations to cover these areas of repeater operation where there were no rules. As you remember, before Docket 18803 the word "repeater" did not even show up in the rules and regulations of the Federal Communications Commission as far as the amateurs were concerned. Anyway, we all expected 18803 to provide us with some guidance in the licensing and installation of FM repeaters. Boy, were we ever wrong. Docket 18803 hit us like a rude noise in church. Docket 18803 as it stands virtually means an end to experimentation on VHF as far as repeaters are concerned. The rules are now so restrictive and so ridiculous as to make it almost impossible to get anything other than a simple (very simple) repeater licensed. Am I exaggerating? Hell, no. Those of you who live in California are well aware of the fantastic work being done in the way of repeater interlinks. It is possible to sit in downtown San Diego and talk all the way up the coast to Northern California and beyond with your walkie. What a great public service these systems are during times of emergency. What about the Chicago Repeater Group with their fine machine? The one with the several receivers and transmitters tied together with an ingenious voting system – I could go on and on describing some great achievements on FM and repeaters but suffice it to say that these achievements must now stop. There is now no way for us to build the ultimate repeater. Why? Docket 18803 and A. Prose Walker, that is why. I mentioned earlier Missouri and the fact that I have always given people the benefit of the doubt. When Docket 18803 came out I tried to steer away from the hysteria being generated by some. I hoped that the obvious faults of 18803 could be ironed out. I envisioned a modified 18803 in the near future that would echo most needs and supply us with what we needed to continue what we had started on 2 meters.

I quietly listened as A. Prose Walker told us how 18803 was the best thing that could have happened to FM. He said we should forget about the negative side of 18803 and recognize the positive side. He said we can now let a fellow from anywhere, even if he has no license, come into our shacks and operate CW. Don't ask me. I'm still trying to figure that one out. Walker told us we should consider ourselves lucky that 18803 is not more restrictive. He told us that we should appreciate the fact that we have our own common carrier systems in the ham bands with which we can link up to telephone lines for autopatch. In the same breath he told us we will probably lose our autopatch privileges because some people are abusing them.

Walker spent a great deal of time telling us how ham radio has changed. He accused us of all being a bunch of appliance operators with no desire to build or experiment. In the same breath, he told us that 18803 would stand. This virtually eliminates any experimentation and building in this phase of the hobby.

We were told that if we did not like 18803 we should petition the FCC to change the rules. Next he told us that all such petitions would be rejected without consideration since the FCC a few months ago rejected – across the board – all petitions to reconsider 18803.

We were accused of letting the public down as far as emergency public service is concerned by not providing the communications needed. But he rejected the idea presented by one individual that repeaters should be able to interlink to provide emergency communications. After the Walker circus had been in progress for 55 minutes, I was actually getting a little sick to my stomach. Walker was threatening us. He told us that we had better shape up or things might get worse. Actually, what Walker was saying to the many repeater owners and users present was, *Tough – this is the way I* (Walker) *want it . . . this is the way it is going to be and there is not one damn thing you can do about it.*

Walker was scheduled to speak for one hour. Everyone expected a question-and-answer period would be most fruitful. However, Walker kept looking at his watch to make sure his talk lasted the full hour and that there would be no time for questions. Due to a mistake on his part, there were about five minutes left after his talk for questions. A few questions were put to Walker. The first: "Mr. Walker, don't you think it unreasonable that one individual can shut down a repeater by simply talking on the output of the machine? Is it not possible for someone with a personal gripe to make it rough for hundreds of repeater users?" To this Walker said no one has an exclusive right to a frequency. The fellow on the output has as much right to be there as the hundreds of repeater users. In other words, Walker opened the door to those very few who can now delight in shutting down all the repeaters they want, simply by calling "CQ" on a repeater output frequency. Another fellow asked Walker why 18803 is so restrictive. Walker had no good answer other than to imply that if we don't like it, tough! It could be worse. I asked Walker if there was any way amateurs could change 18803. He said sure, all you had to do was file a petition. I said, "Did you not say a few minutes ago that you had considered all there was to be considered and that you will reject all petitions for reconsideration?" He said that they had considered all there was to be considered and that petitions for reconsideration would be returned to the sender.

All I can tell you about Walker is what I heard and saw. What I heard was the biggest pile of crock I have ever heard. What I saw, in my opinion, was an egotistical monarch delighting at the despair of the amateurs. I think Walker has a one-man, one-sided idea of what he thinks ham radio is all about and that nothing short of getting him fired is going to save our hobby as we know it. Don't think for one minute that Walker will stop with 18803. He will not.

Those of you who were at Rochester now know A. Prose Walker. Those of you who were not at Rochester, don't take my word for it. Ask around. Ask about A. Prose Walker. Then it is up to you – if you want to lose your hobby as we know it, fine. Just sit back and say to yourself that everything is okay. If you feel that your hobby is worth something to do, do something about it. Write your congressman, write Barry Goldwater, even write Spiro! Do something, for god's sake.

. . .W7DXX/1

CT	WA1PHX	delete	147.76–146.76
CT	WR1AAE	Litchfield	147.49–146.49
CT	WA1PXO	Roxbury	147.90–147.30
IA	WA8VVO	Ottumwa	04–64
IL	WR9AAD	Murphysboro	25–85
MA	WR1AAC	Salem	28–88
MA	WR1AAH	Marlboro	01–61
	ex-WA1QIZ		
MI	WR8AAA	Milford	146.19–146.79
	ex-K8SWW		147.79–146.79
NC	WR4AAA	Salisbury	28–88
	ex-W4EXU		
NC	WA4BVW	Mt. Pisgah	222.46–224.06
NY	WR2AAB	Yonkers	31–81
	ex-WE2BLQ		
OH		Akron	04–64
OH	W8IOO	delete	
PA		Meadville	04–94
UT	WR7AAA	Cedar City	34–94
CANADA			
NS	VE1HR	Fraser's Mountain	28–88

REPEATER APPLICATIONS

In order to build a literature of acceptable methods of getting repeater, control station and auxiliary station licenses, it would be greatly appreciated if anyone or any group managing to get a license application approved would send a copy of the application to us here at *73 Magazine*. We'll try to pass along the info we get in this way through the pages of *73* and in person at hamfests and club meetings. Eventually we may be able to put out a handbook of accepted application answers and reduce getting a license through Mr. Walker to a rubber stamp procedure.

Joe Kasser
1701 East-West Highway, Apt. 205
Silver Spring MD 20910

This month, let's look at the two meter FM activity in and around several areas of the USA. Consider Detroit: Detroit was recently described in an article in *Time* as the Murder Capital of the United States. *Time* also reported that the majority of homicides were committed by friends or relatives of the deceased, so, if you are going to or through the Motor City, *know who your friends are.* Seriously though, Detroit is a great city in which to start a trip to Canada.

Due to the unbelievable slowness on the part of the FCC to issue new repeater licenses, we have been forced to begin running our Repeater Atlas Registration Form every other month.

There are two repeaters in Detroit. K8VLN on 04–64 and WB8CQS on 16–76, both requiring a 100 Hz subaudible tone for access. The 04–64 repeater will only relay tranmissions accompanied by the 100 Hz tone, while the 16–76 one will relay about 3 to 5 seconds of transmission not accompanied by the tone, after having been keyed up by the tone. It is thus possible to tail-gate or work through the repeater provided someone else keeps keying it up every 3 to 5 seconds or so. The 16–76 crowd are very friendly and usually don't mind doing the necessary for transients (or others). The sub-audible tone requirements were added to the repeaters because they were experiencing interference from users of the Toledo and Cleveland (Ohio) and Sarnia (Ontario) repeaters.

WB8BDD 25–85, a carrier operated repeater in Clarkston, Michigan, about 15 miles northwest of Detroit, is workable from the Motor City. I could get into it from the second floor in northwest Detroit using TR-22 when on a recent trip. WB8CSC 37–97 is in Ann Arbor, about 35 miles southwest of the city and not too far from the airport. It has good coverage of the west side of Detroit, but you will normally need more than a TR-22 to get to it from Detroit.

Now consider a different part of the country, the southeast. WA4DGM drove from Maryland to Florida a few months ago, working two meter FM with about 25W output. While on his indirectly routed trip he was able to work through a number of repeaters. For those intending to follow in his tire tracks (in England we'd say "follow in his footsteps," but here everybody drives), here is a repeater by repeater replay of his trip.

Leaving Washington talking on WB4QFP 31–91 and WA3SFG 28–88, he drove down to Richmond, Virginia 34–94. From there he made his way along the Blue Ridge Parkway through Virginia, North Carolina and east Tennessee, working through the following repeaters whilst up in the mountains: WR4AAA 28–88 Salisbury NC, WA4NUO 34–94 Ashville and a 16–76 machine in the Ashville area, as well as a 16–76 in the Roanoke area.

From the highest point in the Smokies he worked through K4HXD 34–94 Knoxville TN and stayed with it over a long stretch of road. Continuing on the trip he worked through W4RFR 34–94 Nashville and K4IKU 34–94 Huntsville AL. For a while no repeaters were heard, until WA5ZHD 34–94 Baton Rouge and a 34–76 machine in New Orleans. There is also W5UK, a 34–94 whistle-up repeater in that city. Driving along the Gulf of Mexico, the next repeater contacted was the 34–94 machine in Mobile AL.

Florida was found to be full of repeaters. He found a 34–76 (PL or 1.8 kHz burst) in Fort Walton Beach near Pensacola and WB4HAE 34–76 in Tampa, which could be accessed from St. Petersburg. When he got to Miami he found WB4HAA on 34–76.

His northbound journey began at Miami. Driving up the Atlantic coast, Merritt Island provided coverage in the Cape Canaveral area. He also worked through Daytona Beach 34–94 and WB4QEL 16–76, Orlando. WB4QEL could also be accessed from the parking lot at Walt Disney World.

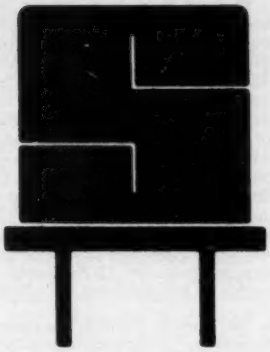
Driving north out of Florida nothing was heard until he came into range of the 34–94 repeater in Charleston SC, and nothing from there until Fayetteville NC 16–76.

WA4DGM pointed out that he passed through many places during normal working hours, so it is very possible some repeaters were not on the air at the time he drove through. Still, he enjoyed his trip, and if you do follow his tire tracks . . . have fun.

G3ZCZ/W3

Bill Pasternak WA2HVK/6
14732 Blythe Street #17
Panorama City CA

Dateline Los Angeles, May 9, 1973: Another chapter in the history of amateur FM communications was written into the books at 4:00 P.M. P.D.S.T. when the WA1KGS repeater in Waltham MA was successfully linked via telephone with the WA6TDD Mt. Wilson repeater in Los Angeles. To our knowledge this is the first time that two open repeaters separated by some 3,000 miles were



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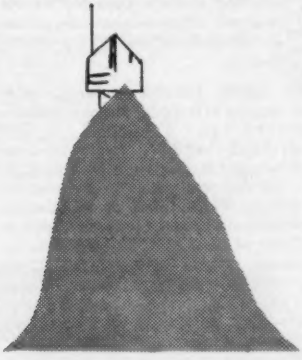

REPEATER USERS

If you want reliable access to the repeaters in your area, you want and need SENTRY CRYSTALS. SENTRY CRYSTALS are custom made for your rig. We don't stock a large quantity of crystals for a certain frequency and hope you can tweak them to frequency in your rig. We do offer FAST service on crystals made especially for you and your rig. If you want reliable, on-frequency operation, INSIST ON SENTRY.

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PHONE: (405) 224-6780
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interconnected in order to give the users of both a chance to exchange calls and get to know one another.

At first it sounded like 20 meters on a Sunday afternoon, but George K1MON and Wayne K1MUC, who acted as control in Waltham, and yours truly acting as Los Angeles control, were able to improvise a system that allowed all participating stations to get in a transmission or two.Among those on hand for this event was Wayne W2NSD/1. I was personally delighted that he was involved and thankful for the encouragement he has given me in this project.

Though I have yet to go through my log tape, I can accurately estimate that in addition to Wayne, some fifty other stations participated in today's bit of ham history. To any of those who tried to get into the system and couldn't make it for one reason or another, we do apologize. This, however, is only the beginning and the future holds more. The system has been proven viable and the road is now open for others. A few years ago no one even dreamed that a two watt hand unit would span a continent. Today a ham at a restaurant in Boston using an HT can talk to a mobile on the Hollywood Freeway. Dreams do come true.

Some of the amateurs calling in on the historic roundtable were WA1QNN, WA1IML, WA1LMJ, K1ETT, W1BHD (op of WR1AAA), WA1LSD, W1YHM, WA1GXN, WA1HXZ, K1HBJ, WA6JGW, K6BWJ, W6UTE, K6LQK, K6PFW – all in addition to K1MON and K1MUC of the WA1KGS repeater, and, of course, W2NSD/1 and WA2HVK/6.

I have spent a number of spring seasons on the west coast, but by far this one is the most colorful I've seen. It's also an anniversary for us; six months in our new adopted home state. Sharon and I were discussing the past six months the other night, and we both agree we made the right move. We're happy here and are going to stay.

A recent event out here was the surprise party given by members of the Pallisades Amateur Radio Club (WB6ZDI) for one of their members who is about to be married. The lucky couple is Ward Hill WA6FUH and his soon-to-be bride, Barb Goldie. This party was the best secret ever kept among the ZDI members, and was a real surprise to Ward and Barbara. The event was held at the home of John WA6ABW, and a quick head count revealed that some fifty people showed up to help make the evening merry. I have said before that amateur radio breeds good friendships.

While on this subject, may we also send congratulations to another newly married couple, Warren and Lorraine Andresen, Mr. and Mrs. WA6JMM. They have just returned from their honeymoon traveling throughout Arizona, and Warren reports that most of the repeaters in the Phoenix area are back in operation. Though for obvious reasons Warren spent little time hamming this trip, he did come up with the following: Both 34/94 and 16/76 in Phoenix are back on the air, though they operate on a limited time schedule. The 16/76 channel is mainly for auto-patch use while 34/94 is the general meeting frequency. Coverage at this time is not good as it could be since these machines are located within the city on an office building rather than at their old mountaintop location. Both machines operate under the call K7VOR. Warren also tells us that there are plans for a new wide coverage mountaintop machine to be put on 04/64 in the near future. He could not get an exact date. At this time it leaves only the 450 MHz machine out of operation, and it is my hope that by the time this article reaches you, it too will be back on the air. Good luck, Phoenix.

Warren also tells us about another repeater in Arizona with near fantastic coverage. This one, K7EIK (146.16–146.76) is located in Kingman and is usable not only throughout Arizona, but as far away as Las Vegas and in parts of southeastern California as well. Sure wish I had that pair of crystals in my RCA when we were driving cross-country. That's what I call coverage. Warren says the people on this machine really went out of their way to be friendly and helpful.

WR6AAA, the Catalina repeater, is on the air and open for general use. The frequencies: 147.69 in, 147.09 out. Coverage: well, the word fantastic would be an understatement!

The new NTW 220 machine is coming along. Warren has already finished the ID unit and Bill just about has the transmitter strip ready to go. I do not know how well the other 220 machines that are being brewed up are coming along. Six meter AM and SSB has been fairly active and in tuning around the band I have located a 6 meter FM repeater. Perhaps those who own it will contact me and give me more information on it. I know it's on Mt. Wilson, but that's about all the information I have.

. . .WA2HVK/6

Tom DiBiase WB8KZD
708 6th Avenue
Steubenville OH 43952

Contest Calendar

July 28–30	CW County Hunters Contest
Aug. 4–5	Illinois QSO Party
Aug. 18–19	N.J. QSO Party
Sept. 15–17	Washington State QSO Party
Sept. 29–Oct. 1	Delta QSO Party

This Month
CW County Hunters Contest

From 0000 GMT July 28 to 0600 GMT July 30, 1973. Call "CQ CH." Exchange QSO number, category (if portable or mobile. If portable send 'P' – if mobile 'M'), RST, State (or province or country) and county (if U.S. station). Stations may be worked once per band and again if the station has changed counties. Stations changing counties may repeat contacts for QSO points. QSO's with fixed stations are 1 point; QSO's with portable or mobile are 3 points. Multiply total QSO points times total of U.S. counties worked. Portables and mobiles calculate their score on the basis of total contacts within a state. Suggested frequencies are 3575,. 7055, 14070, 21070, and 28070 kHz. Appropriate trophies and certificates will be awarded. Logs must show category, date/time in GMT, station worked, exchanges, band, QSO points, location and claimed score. All entries with 100 or more QSO's must include a check sheet of counties worked or will be disqualified. Enclose a large SASE for results. Logs must be postmarked by Sept. 1, 1973 and sent to: CW County Hunters Net, c/o Jeffrey P. Bechner W9MSE, 64 North Pioneer Parkway, Fond du Lac, WI 54935.

August
Illnios QSO Party

From 2000 GMT August 4 to 2400 GMT August 5, 1973. Stations may be worked once per band and mode. Illinois stations contact any station, out-of-staters work only Illinois. Score 1 point per QSO and multiply total QSO points times total Illinois counties worked. Illinois stations use total of states (including Illinois), provinces and countries (including USA) worked for their multiplier. If power input never exceeds 5 watts, multiply score by 3. Also, each group of eight contacts with the same Illinois county counts as an extra multiplier. Remember, USA, Canada, Hawaii and Alaska count again as states. Exchange QSO

number, RST, and state, province or country (county for Illinois stations). Suggested frequencies are 3560, 2725, 3900, 7060, 7125, 7260, 14060, 14275, 21060, 21110, 21360, 28060, 28160, and 28660. Phone on the hour, CW on the half hour. Appropriate awards. Logs must show date and time in GMT, stations worked, exchanges, band, mode, and claimed score. A separate summary sheet is required, showing operator's name and address in block letters, whether single or multi-op, QSO points, multipliers, and score claimed. Logs must be postmarked by Sept. 15, 1973 and sent to: Radio Amateur Megacycle Society, K9CJU, 3620 N. Oleander Ave., Chicago IL 60634. Enclose SASE for results if desired.

Not much to report this month, but this *is* the first one of 73's new regular contest column, and it does take time to get going strong. You may look forward to bigger and better columns in the months to come. As editor, I welcome any and all comments, suggestions, and questions about contests and about this column. If you have information on a particular contest, please make sure I have it at least three months prior to the date of the contest (the sooner the better, though). All correspondence should go to *my* address, which is: Tom DiBiase, 708 6th Ave., Steubenville OH 43952. With your support, this column has the potential to become the finest ham radio contest column ever to hit the pages of a magazine.

Until next month, good luck in the contest pileups!

Tom WB8KZD

The Hamburglar

STRIKES AGAIN!

Bill Grenfell W4GF is offering a reward for information leading to the recovery of the following equipment stolen from his car at Dayton OH onApril 29th: Yaesu FT-101 s/n82G12279/CW, 1.8 MHz & CW filter installed; Regency HR-2, s/n03-02030, xtals 147.00, 146.97/94/91/76/37/34/31/12 MHz. Contact him at 7216 Valleycrest Blvd., Annandale VA 22003. Phone 704-560-5229.

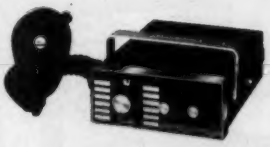
A Clegg 27B, ser. no. 27013-1068 was also lost by Bob Edelman W2BXL last April 29th. His address is 408 Valley Run Dr., Cherry Hill NJ and he may be reached at 609-665-4321 during the day and 609-667-3645 at night.

The following gear was stolen from WB2DEW's car on May 11: Standard 826MA ser. no. 208078 with P.T. mike (new style) and 11 crystals including 147.21/.210; 147.81/.210; 16/76; 147.93/.330; 147.99/.390; 25/85. The 9th position has a bad crystal socket and the channel selector dial on the number 7 position has a deep scratch on it. Johnson Messinger 111 w/mike, converted to 10 meters with 28.730 and 28.650 crystals installed. Both rigs have "Stolen from WB2DEW" engraved in many places on the chassis and circuit boards. Contact Andy Drautz WB2DEW at 4 Pine Rd., Kings Park, N.Y. 11754.

List from Past Issues: Mfr., Model, Ser. No.	Owner	Issue
AF68 No. 10688	K5LKL	1/73
PMR8 No. 10018 M1070 pwr supply		
Trio TR2200 No. 241969	WA2ZBV	1/73
Clegg 22er No. 1900-578	WIDHP	2/73
Standard 826M,No. 112007	WA8PCG	3/73
FM27B No. 27013-1141	W2LNI	4/73
FM-144-10L No. F458 NPC 107m pwr supply 2, SAJ-IPL Onan Gen., No. 327865	WA8WOA	4/73
R4B No. 11678G T4XB No. 17801 G W4 wattmeter No. 8390 Swan 250 No. F154806 Swan ac pwr. sup. No. 0663656	WA8GVK	6/73
HR-2 No. 04-C2879 SB-34 No. 211828	W6GSR	6/73
STD 826 No. 011268 HT220 No. GJ7327	WA2FSD State Univ. of NY (Albany)	6/73 6/73

NEW PRODUCTS

HR-2B



Keeping up with the amateur tradition of technological advancement, Regency has hit the market with a third generation model of the original HR-2 – the HR-2B.

A quick look at the front panel tells the story. Aside from the more professional looking black panel, the crystal switch is now numbered consecutively from one to twelve. The old arrangement allowed only 6 crystal pairs to be installed, with 6 extra positions on the panel switch for re-pairing the same crystals. Regency has increased the number of separate receive and transmit channels to 12 for the obvious reason that most 2m activity is via standard frequency pairs through repeaters. The switch can still be wired so you can use a crystal twice, but the fact remains, the HR-2B gives you twice as many crystal sockets!

The transmit crystals used in the HR-2B are 8 MHz as opposed to the 6 MHz rocks required by its predecessors. This is a reasonable change at a time when most 2m equipment uses 8 MHz as a starting point and increases your chance of being able to walk into a radio store and find a particular crystal in stock.

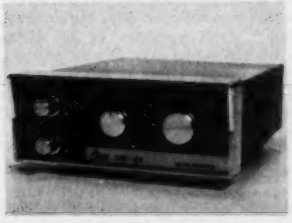
The output is about the same as the HR-2A, 15–20 watts. Added, however, is the HI/LO power switch which reduces the power output to 1 watt. This feature is becoming increasingly popular with FMers because it allows a standard mobile or base station rig to double as an over-the-shoulder portable unit when connected to an external battery pack. That one watt level also lets you keep the battery size down to reasonable proportions.

The receiver is still rated at the excellent figure of 0.35 μV for 20 dB of quieting and the selectivity has been improved by the addition of a series "E" filter in the i-f for less cross-channel interference.

For a rig that has been improved and made more versatile, Regency is asking the same price . . . $229.00 – this includes the HR-2B, mike, crystals for 94–94 simplex and mobile mounting bracket.

For more information write *Regency Electronics Inc., 7900 Pendleton Pike, Indianapolis IN 46226.*

CLEGG FM-21



When the Clegg engineers sat down to design a 220 rig, they most certainly at one point went the route that is the industry standard – one crystal controlling the transmitter and another for the receiver. That the

system works well is attested by almost every commercial FM rig on the market today. In fact, on 2m, any system that does not allow independent selection of transmit and receive frequencies via separate crystals is bound to cause trouble when trying to work into oddball-paired repeaters.

At one point however, someone at Clegg with sense, realized that the 220 MHz was fast becoming organized . . . everyone was agreeing on a standard 1.6 MHz spacing between the inputs and outputs of repeaters. Since a transceiver was now being designed to work within an accepted set of frequencies, the designers devised an ingenious system that sets the transmitter output on one frequency and gives you the choice of receiving on that same frequency for simplex or 1.6 MHz higher for repeater work . . . all with a single crystal! This is accomplished by judicious mixing during both modes.

On transmit, the switch selected channel crystal (45 MHz for example) is first doubled to 90 MHz. Then it is mixed with a crystal controlled 20.5 MHz signal to produce 110.5 MHz which is ready for doubling again to 221 MHz.

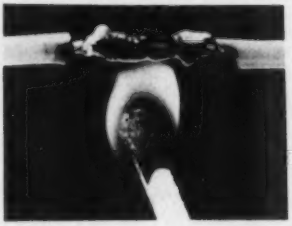
The receive process is slightly more complicated. The already doubled channel crystal frequency is doubled again to 180 MHz and injected into the first mixer. If you are working simplex, the 221 MHz received signal will be mixed with the LO signal to 41 MHz in the first mixer, and it is mixed again with a 30.3 MHz signal in the second mixer to ready it for the 10.7 i-f. If you are working in the repeat mode, the receiver will need the capability to handle a signal that is 1.6 MHz *higher*. This is accomplished by switching in a 31.9 MHz oscillator to replace that on 30.3 – thus the second mixer can now only convert a 42.6 MHz signal to 10.7. Working backward to the antenna, or adding the original LO signal of 180 MHz to 42.6, gives you the signal that will be accepted and received – 222.6 MHz, which is exactly 1.6 MHz higher than the transmit frequency of 221 MHz produced by the same 45 MHz crystal.

The receiver is rated at 0.25 μV for 12 dB SINAD with adjacent channel rejection down 50 dB at 40 kHz. The audio output is an adequate 1.5W.

The transmitter delivers 8–10W output and is protected against any rash swr changes due to forgetfulness on the part of the hand that usually screws a coax connector down tight. The supplied noise cancelling mike works in conjunction with a clipping circuit that is adjustable to provide up to 10 dB of clipping action and deviation may be set anywhere from 0 to 7 kHz.

Crystals aren't a problem as they can be ordered on a 24-hour basis from Clegg for $4.95. The unit comes ready for 6 channel operation and 5 extra channels can be added with an inexpensive conversion kit. One needn't worry whether or not 220 will remain with 1.6 MHz spacing, for the rig can be easily modified for receive/transmit channel spacings from .1 to 3 MHz. For more information, write *Clegg Division, International Signal and Control Corp., 3050 Hempland Road, Lancaster PA 17601.*

TAPE SOLDER



Ever wish you could solder a connection with a match? Now you can with Archer Tape Solder, from Radio Shack. Simply twist your wires together, wrap them with a piece of Tape Solder, and melt it with a match, candle or cigarette lighter flame. No soldering iron needed. Tape Solder seems ideal for on-the-spot wiring and repairs, slicing wire, fixing rotor cables half-way up a tower or any normal soldering job out of reach of a soldering iron. Archer Tape Solder comes in a resealable plastic pouch of 100 pre-cut pieces for 89¢.

Tape Solder is available from more than 1800 *Radio Shack* and *Allied Radio Stores* in all 50 states and Canada.

LOW PRICED DEVIATION METER

The ECM Corporation has announced a deviation meter designed especially for the ham. The ECM-5 covers all ham bands between 52 MHz and 450 MHz, and features a peak reading meter. Deviation of any FM transmitter can be accurately adjusted between 5 kHz and 25 kHz in seconds using voice or tone modulation.

The Model ECM-5 closely follows the circuits used in professional equipment except frequency selection is crystal controlled. This allows the elimination of many expensive circuits needed when frequency selection is by VFO. The net result was a tremendous reduction in price without sacrificing quality . . . $75.00 less batteries and crystals!

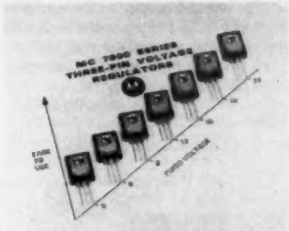
The frequency selecting crystals are the popular, subminiature type used in today's FM rigs. These crystals were chosen for their low price and availability.

The peak reading meter has a special time constant circuit that causes the needle to deflect upscale rapidly and downscale slowly. This allows the needle to follow voice peaks easily and increases the accuracy of readings when checking deviation using voice modulation.

Other features include built-in or external antenna, all solid state construction, battery powered by inexpensive AA pencells, and a battery condition indicator.

For more information, write *ECM Corporation, 412 N. Weinbach Ave., Evansville, Indiana 47711.*

NEW VOLTAGE REGULATORS



Many times the need arises for a simple, low-cost voltage regulator which can provide a moderate amount of current without complex current-boosting circuitry. The MC7805/24 series positive voltage regulators can supply in excess of 1 amp at nominal voltages of 5, 6, 8, 12, 15, 18 or 24 volts (as designated by the last two digits of the device number). However, unlike most voltage regulator ICs, these devices have only three terminals – Input, Output and Ground. They require no external components! They can be easily attached to a heat sink surface with a machine screw through the hole in the package to attain higher maximum power dissipation. The maximum input voltage is 35 volts on all types except for the MC7824 which is speced at 40 volts.

All seven members of this inexpensive regular family are presently available from warehouse stock.

For further information please contact the *Technical Information Center, Motorola Inc., Semiconductor Products Division, P.O. Box 20912, Phoenix, Arizona 85036.*

LEE SERVISET

When something goes wrong with the test setup for the 73 Crystal Bank, it has to be fixed quickly. Here's Wayne using the Lee Labs Dynamic Serviset in one of its many functions as an rf signal tracer. The Serviset has the ability to trace rf and af signals, check ac or dc voltage levels and substitute resistance and capacitance values by simply changing a test lead. It takes the place, on a basic level, of at least three or four expensive pieces of test equipment.

The unit is entirely self-contained, which means the cords that usually dangle and cause problems in most test setups are eliminated. Printed circuits are tested with ease for the main test point is long enough to get into the tight spots where a clip lead cannot go.

For more information about this versatile piece of test gear write *Lee Electronic Labs, 88 Evans Street, Watertown MA 02172.*

HAMBURGLAR HQ FOUND! W7AYQ seems to think he has found the head office in Florence, Oregon.

GI6YM AWARD

1973 is the golden jubilee of the city of Belfast YMCA Radio Club GI6YM, Northern Ireland, and the members are celebrating the occasion with a number of special activities.

This club jubilee also happily coincides with the 75th anniversary of the wireless tests carried out by Marconi and Kemp on behalf of Lloyd's, between Ballycastle (Co. Antrim) and Rathlin Island off the North Irish coast, to report ships passing the N.E. corner of Ireland.

These tests were successful and established the "first public service" of wireless in the year 1898.

To commemorate both these milestones, the Belfast YMCA Club will issue an award certificate between 1st July and 30th June, 1974.

Activity from GI6YM will be at a high level throughout the period. In conjunction with members of GI3FFF, the Ballymena Amateur Radio Club, a special station will operate from Ballycastle on all hf bands during the first week in July with the call letters GB3MKB (Marconi Kemp Ballycastle).

It is known at this point that one requirement for the award will be contact with both the YMCA Club Station (GI6YM) and the Special Activity Station at Ballycastle during the period of the town's Marconi-Kemp celebrations. This award will also be available to shortwave listeners.

HAMFESTERS

The Hamfesters 39th annual hamfest and picnic will be held Sunday, August 12, 1973, at Santa Fe Park, 91st and Wolf Road, Willow Springs, Illinois, southwest of Chicago. Exhibits for OM's and XYL's, famous Swappers Row. For information contact John Raiger K9DRS, 8919 Golfview, Orland Park IL 60462. Tickets: write Joseph Poradyla WA9IWU, 5071 So. CAlifornia AVe., Chicago IL 60629.

JUNCTION, TEXAS BAR-B-Q

The third annual Amateur Radio Appreciation Day will be held in Junction, Texas July 29, 1973. This is a FREE Bar-B-Q for anyone holding an amateur license, and their family.

The day is sponsored by the Kimble County Chamber of Commerce to show its appreciation of the many public services and disaster assistance amateur radio operators provide.

For complete information contact WB5BBT, Lewis Ransom, Junction TX 76849 or the Kimble County Chamber of Commerce, 603 Main, Junction.

TWO RIVERS MEET

The Two Rivers Amateur Radio Club will conduct its ninth annual hamfest on Sunday, July 22, 1973. The event has grown to be one of the largest hamfests in Western Pennsylvania, and this year will be held at the Green Valley Fire Department grounds, off U.S. Route 30, near McKeesport, Pennsylvania. For complete details write Robert E. Zimmer WA3OGS, 205 Commonwealth Ave., West Mifflin PA 15122.

TURKEY RUN-FEST

The Wabash Valley Amateur Radio Association will hold the 27th annual VHF picnic and hamfest on Sunday, July 29, 1973, at Turkey Run State Park near Marshall, Indiana. Registration is $1.50 or 4 for $5.00, with no advance registration. There will be prizes, XYL Bingo, huge flea market and plenty of good fellowship. Talk-in is on 94/94 and 52.525 MHz.

SWAPFEST '73

The South Milwaukee ARC presents its annual hamfest on Saturday, July 14, at the VFW Post 434, 9327 Shepard Ave. in Oak Creek, Wisconsin. Admission is $1.00. There will be food and prizes available. Talk-in on 146.94.

MT. AIRY PICNIC

The Mt. Airy VHF Radio Club (Pack Rats) will hold the 18th annual family day and picnic, Sunday, August 12 (rain date August 19) at the Fort Washington State Park, Flourtown. The event features games, entertainment, and free soda. Talk-in stations will be on 50.2 MHz AM, 52.525 MHz FM, and 146.52 MHz FM.

INTERNATIONAL HAMFEST

The 10th annual international hamfest will be held July 7 and 8, 1973, at the International Peace Garden between Dunseith, North Dakota and Boissevain, Manitoba. This event has grown from a small family picnic to a gathering of radio operators and their families from California, Washington, Minnesota and Saskatchewan as well as from North Dakota and Manitoba. There will be activities, prizes and general hamfest fun. Contact Mel McKnight WAØSJB, 909 Main St., Bottineau, ND 58318 for further details.

W2NSD/1 continued from page 4

Walker came down hard on mail order licenses – saying that a high percentage were fraudulently obtained. This was a bitter pill to have to accept out there in Western New York – where a fair percentage of the amateurs present at the banquet were Conditional licensees. Obviously there is no way to know this for sure, so this is merely a matter of opinion. In talking with Walker I've found that this opinion appears to have been derived from the number of Conditional and Technician licensees who refuse to appear before an FCC examiner when called in.

As I have pointed out before, there are other possible and reasonable explanations for this and the assumption of guilt on the part of those who default is unfair. Only about 50% (tops) of the licensed amateurs are active in the hobby. Can we expect an inactive amateur to go to all the work it takes to prepare for the license exam? By the time he's gotten a book with the latest questions and answers in it and started to bone up, the date for appearing is past. Of course his decision to give up without trying could be based upon the tremendous changes in the exam since the time when he took it – which in the case of most Conditionals was many years ago. Many years. One look at the solid state questions – the RTTY questions – the sideband questions – and it's back to stamp collecting or wenching.

How many wives will be interested in the trip to the FCC office? A great many hams have coached their wives so they could pass the exams on memory alone. Naturally this short term memory material is long gone and, if the wife has to do it over, she will have to start from scratch. The answer is phooey.

The word is getting around too of the high percentage of hams who are flunking their re-exam. In some reported cases over 90% of those who did make the try to hold their license were failed. To say that amateurs, some with over twenty years of hamming – some experienced builders – are upset over being failed is a gross understatement. How would you like it?

As far as I know from talking with Walker most or all of these chaps are considered by him to be obvious cases of fraudulent licensing. Oldtimers who have even the slightest question in their mind about what Conditionals and Techs face in the present day license exam would do well to get a copy of the *73* license study course book for the General License. The book simplifies the understanding of the material – still, it is going to take some time.

The introduction to Walker opened some eyes. FMers have been wondering what possible reason there was for all those antenna radiation patterns for the repeater antennas. The intro explained it – Walker has been working up until taking over as chief of the amateur and citizens division of the FCC making such patterns – it is a special interest of his. Now he has the amateurs over a barrel and is forcing them to provide him with data for his own pet project at the expense of the amateurs. No other explanation makes any sense.

And just in case anyone present thought that they somehow might be able to manage to live with the regulations Walker has already put out, he hinted strongly at some he has in the works – like the type acceptance of ham gear – a power/bandwidth limitation – stuff like that. Then, with a smirk, he threw down the gauntlet to the ARRL by suggesting that if we didn't like it, sue the FCC and see where that would get us.

It was a bitter pill for those gathered at Rochester for fun and camaraderie to have to sit at the banquet and listen to Walker drone on with his prepared speech for one full hour, taking amateur radio to task from every angle and then going over the talk a second time and repeating everything just to make sure the message was loud and clear. Even if the things Walker was saying were true the whole talk was in exceptionally bad taste.

Walker revealed himself to the entire group as an opinionated, close-minded cantankerous old man who, through some dreadful bureaucratic error, has been put into the worst possible job.

After the banquet the hamfest committee, despite being angry at Walker speaking for one hour when he was supposed to talk for 20 minutes, managed to spirit him quickly out of the hall past the smell of hot tar and the sound of clucking chickens.

FENCED IN

Repeater groups have run into the biggest wall of paperwork in the history of amateur radio. Attempts at penetrating the wall have been vigorously fought off by Walker with indecision and vacillation. This is most frustrating when you consider that all of the decisions have to come from Walker – he is the only gate in the wall – and he is becoming known as the Walkergate of the FCC.

The Walkergate is closed most of the time – about 95% of the repeater applications have been refused. Perhaps an investigation is in order. Many clubs are asking more and more pointed questions about the need for showings on antenna patterns – they want to know whether these are for personal private projects of Walker and whether they might be material for a book he personally has in the works. This is the first explanation that makes even a shred of sense, even though it raises serious questions of impropriety on Walker's part.

The Walkergate has closed on remote base operation as it has been developed over the years, shutting down some of the most innovative amateur work ever set up.

The Walkergate has closed on crossband repeaters – and is closing on all crossband developments – despite the hobbling effect this obviously will have on amateur ingenuity and emergency service.

The Walkergate appears to be swinging open to accept the limitation of twenty feet above existing structures for amateur towers and antennas and also appears to be opening wide for giving more channels to those poor crowded CB'ers.

TWO METERS GOING THE CB ROUTE?

The two meter repeater regulations are, to quote ARRL staffer McCoy, "asinine." The fact is that you will not find one knowledgeable FMer who does not agree with this estimation.

The result of this is that repeater councils are now thinking more and more in terms of outright violation of some of the new regulations. They protested the new rules as soon as they were announced, but Walker refused to even acknowledge the amateurs – throwing out each and every plea for reconsideration. Thus the worst regulations ever put through by the Commission were followed up by the biggest slap in the face amateurs have ever received.

Amateurs felt that this was one hell of a way to be rewarded for being the most well behaved group of licensees the FCC had. On the one hand amateurs could see the CBers running wild, with the Commission turning their face away from the mess they had generated – and even getting ready to reward this bunch of hooligans with a good part of an undeveloped amateur band – one which

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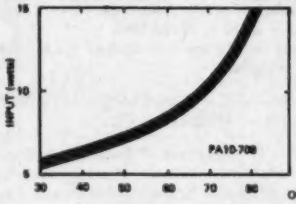

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	PA10-70B	5 – 15	70	7.0	6.5 x 7.5 x 3"	129.95
	PA2-70B	1 – 4	70	8.0	6.5 x 7.5 x 3"	149.95
	PA10-140B	5 – 15	140	18.0	6.5 x 10 x 3"	179.95
	PA2-140B	1 – 4	140	30.0	6.5 x 10 x 3"	199.95
220	PA10-80F	5 – 15	80	7.0	6.5 x 7.5 x 3"	139.95
440	PA5-35C	4 – 8	35	5.0	6.5 x 7.5 x 3"	129.95
	PA2-35C	1 – 4	35	6.0	6.5 x 7.5 x 3"	149.95

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is finally getting ready to be seriously used by the amateurs. On the other hand the Commission (in fact, Mr. Walker) was moving to shut down repeaters – to make remote base stations virtually impossible – stopping experimentation – discouraging invention and development of emergency services – and making life miserable with a mountain of paperwork and license fees.

LICENSING REPEATERS

As more and more repeater groups get fed up with the seemingly total insanity issuing from the FCC, and as the deadline for having a license for the repeater nears – frustration, resentment and a to-hell-with-them attitude seems to be gaining ground. They are not unaware of the annoyed arrogance reported by ARRL staffers to be the attitude of Mr. Walker.

The groups are questioning the ability of the FCC to make the ridiculous rules stick. After all, they muse, if the FCC is totally impotent in the face of the mess on the CB band – there isn't much they can do to enforce senseless rules on hams.

It is sad to see the closed-minded attitude of Walker's office turning the most behaved group of licensees the Commission has into a bunch of revolutionaries who are so furious they are considering breaking their long standing pattern of being the least trouble to the FCC of all their licensees.

THE PETITION

Many have arrived – and I need many, many more. Please make up a sheet of paper with "I petition the FCC to reconsider docket 18803" on top and have as many amateurs sign it as possible – please include their calls, addresses and zip. Send them to me . . . Wayne Green, 73 Magazine, Peterborough NH 03458.

Several readers have called to tell me that ARRL officials have been telling clubs and hamfests that the petitions are a waste of time and effort – that they will do no good. If I was not sure that they could do some good I would not go to all that work. The fact is that we have no other way to go that holds any reasonable promise of success.

Petitions to the FCC will not do any good, I suspect. Mr. Walker is too powerful there and may be able to get any and all petitions thrown out without even the slightest consideration as he did the last batch – including the hundreds of letters of protest. No, I can't see any good to come from going the "official" route.

Frankly I have never had any intention of merely filing them with the FCC so Mr. Walker could throw them down the drain with the garbage. I intend to do what I can to see if there is any possibility of getting action some other way. I want the biggest pile of petitions I can get to carry with me to Washington when I talk with as many senators as possible about the terrible situation amateur radio is in today.

If I can talk with Senator John Pastore of Rhode Island, the chairman of the Senate Communications Subcommittee and explain what the problem is – why it is important – and show him a sheaf of Rhode Island signatures, then it just might get things started. I have 48 signatures from Rhode Island so far – and I need more – lots more.

If I can talk with Senator Howard Baker of Tenessee, the man who heads up the Amateur and CB Division of the FCC – and show him names of constituents, it could help. I have only five signatures from Tennessee so far and I need more – lots more.

If I can arrange to talk with Senator Kennedy of Massachusetts and explain the ramifications of the situation, together with a bunch of signatures, he might be able to put in a word that would help to get Mr. Walker transferred. I have 37 Massachusetts signatures so far and I need many more.

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I'd certainly want to see what we can do with Senator Goldwater, but with only ONE Arizona signature I don't have a very loud voice yet. Is there only one concerned amateur in all of Arizona?

Please see what you can do to get signatures on petitions. When getting non-F Mers to sign, point out that the disastrous rules are hitting all aspects of the hobby, but that we are choosing this one docket to make the fight because it is so clearly detrimental to amateur radio in so many ways. If we try to fight many different dockets all at once we will lose our punch.

To date I have a little over 1000 signatures on the petition from 38 states. Michigan is leading with 257 and Ohio is second with 213 — and we nave 56 from Utah, so let's get cracking!

Put it this way — what have you to lose?

AIRBORNE REPEATERS?

While much of the country is presently served by repeaters, emergencies and disasters can strike anywhere — even where there may not be an open repeater. In the recent past amateurs have responded by going into the emergency area with a portable repeater and setting it up — this is what was done during the floods in Pennsylvania.

A faster way of getting a repeater into service where needed would be to have one that can be set up in a plane and flown around over the area needing communications. This would be able to serve a much larger area than a regular repeater — would not go off the air if power fails (as it usually does) — and could be available anywhere.

A communications system built upon an airborne repeater would be of incalculable value. The wide area it would serve would enable hand units to be used to talk with other hand units (or mobiles or base stations) over a range of two or three hundred miles, if needed.

Such a system is not likely to spring from nothing into full bloom. The fact is that though we know we can set such a thing up, there are a lot of experimental details that will have to be ironed out before it would be dependable. This means experimenting — trying it out — encouraging repeater groups around the country to set up airborne repeaters and use them. We have to find out how best to separate the transmitter and receiver so the repeater is sensitive and effective — we have to know what ranges we can depend upon from various altitudes — etc.

Keith W7DXX, the managing editor of 73, has a small Piper Cherokee plane and the interest to set up such an experimental system. We even have a nice small Standard two meter repeater (now in use as WR1AAB) which could be pressed into service to check out the idea. We're not sure whether it would work better with a small diplexer or with a trailing antenna for transmitting, getting the separation that way.

Before any experimenting can be done there is the problem of licensing the repeater — and this is such a major problem that it may be insurmountable. Keith called Walker to find out about getting the license and was advised that he would need a separate license for every call area over which he would fly. This would mean at least five licenses, minimum, for the W1-2-3-4-8 areas are all within a short flying distance of New Hampshire and

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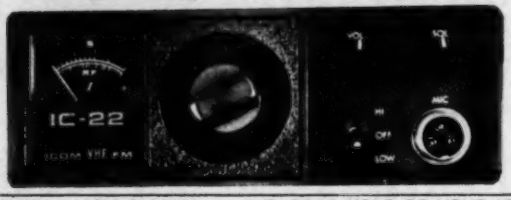

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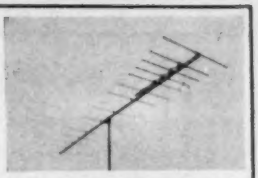

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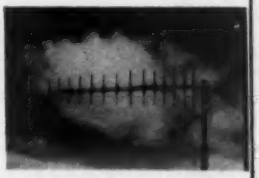

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all get visited quite a bit. That's $45 in fees, plus the piles upon piles of paperwork.

The FCC is making the development of innovative systems such as this extremely difficult to set up and license. When you consider the value of an emergency repeater that is airborne, something is seriously wrong with the FCC when they interfere to that extent.

One of the basic reasons for amateur radio's existence is the development of equipment designs and techniques which will be of value and further the state of the art. The degree that Walker's regulations are making this difficult is such that the effectiveness of the amateur service is being seriously impaired.

AMATEUR RADIO HERITAGE

Present day amateurs may have forgotten some of the invaluable work of earlier amateurs. The fact is that amateurs have done a great deal of development of radio communications – not only in the remote past, but in the recent past.

We are all familiar with amateurs being thrown upstairs into the unwanted short waves a couple of generations ago. Okay, so be it – and we got to work and made the frequencies valuable. As we increased their value we were gradually thrown out – finally to be left with little slivers here and there.

But what have we done for radio recently? A lot – a whole lot.

Let's go back not very many years to the beginnings of sideband. How many of you know how SSB got started? You've probably heard that it was in commercial use for many years before amateurs started using it. What you may have missed is that it was in use on the low frequencies, and that until an amateur (Villard) invented the phasing type rig it wasn't practical on the high frequencies. Once amateurs got going with sideband it swept amplitude modulation right out the window. Sideband was, in all practical senses, an amateur radio invention.

How about narrow band FM? Another ham first. Jack Babkes W2GDG did the groundwork on this in the late 40's and founded Sonar Radio to build the first NBFM gear. And what are we using on two meters today? NBFM.

Have hams invented anything else? You bet – Sam Harris W1FZJ invented the parametric amlifier on six meters – and that was in the late 50's. And how about most of the present day commercial RTTY circuits – designed by hams for ham RTTY. How about slow scan television? Hams again.

Did you know that virtually all of the repeater control circuits being invented today are coming from hams? We're still at it.

But the end of the line is approaching unless there is a basic change at the FCC. The new regulations are crushingly restrictive – they thwart and prevent experimentation and development of new circuits and ideas. They discourage innovators.

THAT EXTRA CLASS LICENSE

Judging from talks he has given, the Extra Class license is dear to Walker's heart and he is dedicated to its furtherance.

Judging from the growth curves from the FCC, amateurs could care less about the Extra.

The Extra Class license was first available in 1952 and about 4000 who had previously held the ticket were grandfathered into it. No privileges were given to licensees, so interest in it was about zilch.

The punishment licensing regulations went into effect in 1967 and this forced a few amateurs to take the Extra Class exam in order to continue to use the frequencies they had been using previously on 75m and 15m. There was a little spurt as a result of this change in band allocations. This soon settled down to a miniscule

growth of about 50 licenses per month – and that comes to an increase of 0.019% (and if that isn't miniscule, what is?). That comes out to a one percent increase in about five years!

That also equals about the biggest bomb ever laid by the FCC – unless you count the recent repeater regulations, which still is unknown as to end results in number of hams forced out of the service and number of people killed by the lack of repeaters on the air to save their lives. The results of the punishment licensing bomb are now known and proven – and even the worst predictions have been exceeded by the test of time. In the face of this catastrophe will Walker continue to punish us or will reason at long last prevail and the rules be changed to benefit the amateur service instead of louse it up?

If you've invested in one of the new calculators you can have fun with those figures. You can figure out the yearly and total increases or decreases for each class of license – and overall.

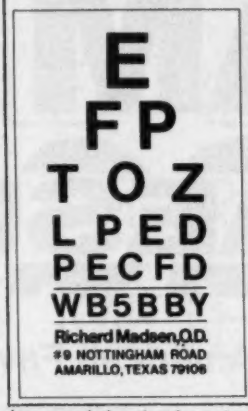
When you look closely at the Extra Class licenses you find that there has been an increase – but it is less than 3% of the ham population over a seven year period! You will also note, perhaps, that the increase was briskest about five years ago and that it has tapered off substantially to where it is going up about 1% of the ham population in five years at present – unless it drops off even more.

Looking at the other classes of license we find that in terms of the ham population they have changed as follows: Novices are up 3.5% – Techs are down about 3% – Conditionals are down 4% – Generals are down 7.3% – Advanced are up 7.8% and Extra are up 2.9%. The total ham population has gone down by 112 in seven years.

The result of the policy of virtually eliminating all Conditional licenses which went into effect several years ago can be seen to be choking them off gradually.

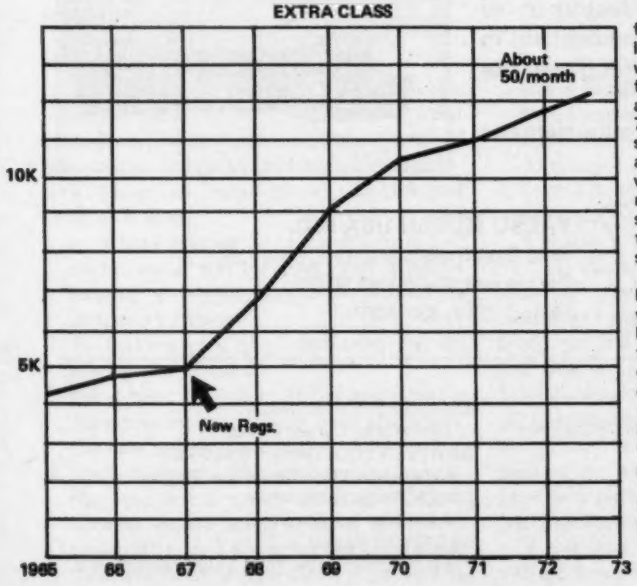
The number of Advanced and Extra increases are about equal to the losses in General and Conditional. The 7.8% Advanced increase indicates that this class of license has been accepted, though not to any degree as expected by the Commission. That evens out to about 1% per year – so all we have to do is wait one hundred years, right?

QSL CONTEST



WB5BBY wins a one year subscription to 73 for submitting the most unusual entry this month. WBØIQK receives an honorable mention for submitting the most . . . well, how could we resist?

Send your QSL to: *QSL Contest, 73 Magazine, Peterborough NH 03458.*



OPEN LETTER TO DANNALS

Harry, I understand that you have been speaking at ham conventions and telling listeners that I was deceitful in getting my repeater license WR1AAB. I know that you would not dare to face me publicly with such a charge.

The license was in no way deceitfully obtained. After talking at great length with Mr. Walker I determined what I considered the simplest system for getting a repeater license. I wrote about this in the Repeater Bulletin, in 73 and I expounded on it at two FM symposiums put on by 73 Magazine and also at several hamfests and conventions. I did exactly what I recommended others do: apply for a very simple license so as to get a call and then hassle over remote control and special antennas later on.

The fact is that WR1AAB was licensed to my home in Peterborough with no remote control and with a half wave dipole. The repeater is on the air from my home under my direct control and using a half wave dipole for the transmitter, as licensed.

It is also a fact that the bulk of the repeater licenses issued by the FCC went to groups that followed the system I have propounded. I believe that WR1AAA, WR2AAA, WR3AAA, WR4AAA, and WR8AAA all used this sytem to get their calls.

Cont'd. on page 93

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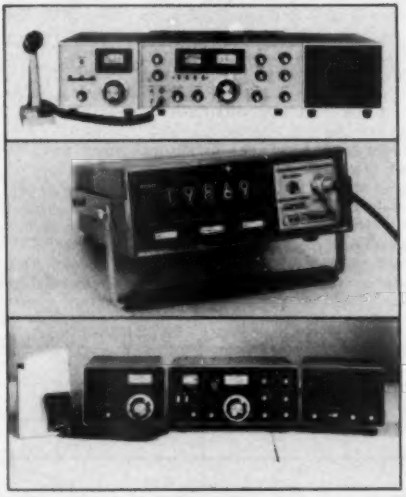

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TUNABLE RECEPTION FOR TWO METER FM

The two variable oscillators described can be plugged into the crystal socket of any receiver or transceiver using 45 MHz receive crystals. The result is a highly stable tunable receiver covering the entire two meter band.

This article describes a working, tunable, IC local oscillator covering 146 to 148 MHz, that can be plugged into a crystal socket of almost any of the 2 meter FM receivers sold in the USA. You can build a few for yourself and friends, but please note that a patent has been applied for on this unit and its uses.

Design Theory and Philosophy

A lot of tunable oscillator design, including my own up to now, has suffered from precedent, habit, and a general lack of innovation. Long-time and sound consideration brings to light certain fundamental facts, as follows:

1. It is hard enough to make a simple L-C circuit stand still by itself, even without hanging a variable capacitor around it, such as a transistor.
2. To make a very good oscillator, you do not have to do that.
3. Use a basic L-C made of the best possible components, temperature wise, along with the best possible mechanical construction.
4. Use a high-gain stable, compound amplifier, one that is good to at least 50 MHz, because we are going to use it around 22 to 24 MHz, as a driver for the L-C circuit.
5. This amplifier should have a bandwidth which at least covers the frequency range we will use, in a reasonably flat fashion. This will only be some 200 kHz or less at 22.7 MHz, so it is not difficult.
6. Use the maximum gain of the amplifier, and minimum feedback to the L-C so that the L-C will control, by some 98 to 99%, the frequency of the oscillator.
7. Run the oscillator at a frequency where it will not jump around. Inasmuch as good, stable oscillators for receivers on 30 MHz have been made for at least 35 years that I know about, anything there or lower will do nicely.
8. Start off with at least a reasonably good and rigid mechanical foundation.

I bolted a thick piece of copper-clad on top of aluminum chassis. A Miller dial, slide-rule type, was bolted on top of that with heavy angles, and that did it. It tunes nicely up and down 2 meter FM sidebands, and beat a 147 MHz signal with precision. The tie points I used are my regular ones, .021 common pins, hammered into .020 holes in fiberglass strips. I actually used glass-epoxy with the copper pulled off (just because I didn't happen to have any around without the copper).

I put in a simple 6V zener to keep the voltage both down and constant. This oscil-

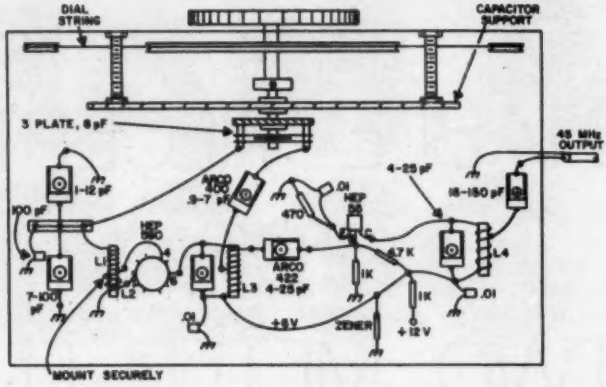

Fig. 1. Pictorial layout of the single IC plug-in local oscillator. See Figs. 2 and 5 for circuit details. This layout will lend itself to a compact construction limited only by the size of a good vernier dial.

lator is extremely unresponsive to voltage changes, but most IC amplifiers use 6V maximum and you do have to run from 12V, for car and battery operation, which may go from 11 to 15V, so at least one zener is indicated.

Couple the IC to the L-C in a manner so that the least frequency change possible will be produced. Once you have done this, and the other things mentiond above, you will have a vfo that is a pleasure to use. Mine is out in the open like all my breadboard jobs, but you can put your hand anywhere on it, except within an inch of the primary L-C, and not notice any change in frequency when listening to 2 meter FM stations. What more can you ask?

Layout

Figure 1 shows the layout used. You can put it in a small box or case if you wish, for use on top of the receiver, but better get one working first in order to have all the components tested and ready to go. Once you get them into that small case it is not so easy to modify or exchange those small units. Just be sure and observe the guidelines, and it will work for you, too. But don't leave any out!

Circuit

Please refer to Fig. 2 for the circuit. To be noted first are a number of capacitors across the L-C circuits starting with L1. C1 is operated by the dial. You have the choice of tuning over 2 MHz, 146 to 148 MHz, or using a switch and putting in two capacitors at the C3 position, one to set the receiver for 146 to 147 MHz and the other for the 147 to 148 MHz range. Of course the mixer injection is actually on 146 to 148 MHz minus the 10.7 i-f frequency. Suit yourself on the question of one or two MHz ranges. Using the whole dial for each MHz makes the tuning easier but requires a few more parts. Remember that the oscillator is actually on 22.716 for the receiver to be receiving on 147 MHz.

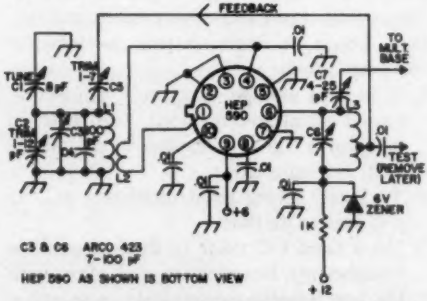

Fig. 2. Ultra stable oscillator shcematic. L1, 10T No. 24, 1.3 cm long, 0.5 cm I.D.; L2, 2T over or close to cold end of L1, coupling should be adjusted for minimum reaction while maintaining good oscillator output; L3, 13T No. 24, 1.3 cm long, 0.7 cm I.D., tap at 3T from ground end.

C2 makes it easier to set C3, which has too much capacity to set easily. It can be done, but setting the dial with C2 is better. C4 is an additional fixed capacitor to bring the C up to the desired point of bandspread so that C1 will cover one MHz, with about 5% to spare on each end. I trust you are familiar with this method. The more C you put across L1, the wider on the dial is spread the one MHz you are looking for.

The tuned circuit of this oscillator is not connected to the collector or the base of a transistor. It *is* connected, via a low impedance link, to the input of an IC compound amplifier. The output of this high gain IC goes to a non-critical tuned circuit, L2, which is quite separate from the frequency determining L1. A one pF capacitor couples energy from L2 back to L1. In this manner the IC output circuit is very lightly coupled to L1. This is made possible by the high gain of the 590 IC and its very low reverse transconductance. This parameter, generally written as "Yr," is the one that in any usual bipolar transistor is high enough to cause self-oscillation unless neutralized. The different result, in a compound amplifier device such as the IC used in Fig. 1, is a very stable oscillator which handles in a superb fashion as a tunable L.O. for 2 meter FM receivers.

Details

L1 is not critical. However, it should be noted that there is quite a large C and a low L. In fact the inductance of L1 is so low that, if used with a low C it will tune way over 100 MHz. So we find about 200 pF across L1, which puts it into the 22 to 23 MHz region. It is then multiplied in a doubler to 45 mHz which is cabled into the receiver crystal socket. This is then used for the tunable L.O. of the receiver, which was previously crystal controlled, and becomes multiplied to 136 MHz in the receiver. With any suitable slow-motion dial, the tuning is now about as easy and non-critcal as on any band in the hf region of 2 to 30 MHz. I used a 25-year-old Bud 3 plate variable in parallel with all the other capacitors across L1, totalling around 200 pF. This produced a tuning range of a little over a MHz when multiplied by six, landing in the 135 to 136.3 range for use as a 2 meter L.O. with a 10.7 i-f frequency.

C4 should be a silvered mica or any other non-shifting-with-temperature capacitor you may favor. C3 is a trimmer for use in setting the dial for 146 to 147 MHz, the second from 147 to 148 MHz, if you use the switch method to cover the 2 MHz range. C1 is the 8 pF you tune with, connected to your favorite dial. One of the nice things about this L.O. is that, taking all the items together, there isn't any one of them alone really critical. I just mounted the 8 pF on a rigid sub-panel of copper clad in back of the front panel (see Fig. 1 again), and that was it. Dividing the 1 MHz L.O. tuning range by 6 comes out around 166.5 kHz, which is all the tuning range required of the 8 pF variable at 22.7 MHz.

Internal schematic of the Motorola HEP 590, shown in Fig. 3, discloses Q1 as the common emitter amplifier driving Q2, a grounded base stage in the cascode configuration. This is called a compound amplifier. I have used the 590 for several years now, as 73 Magazine readers know, and it has always performed well. It has high gain and requires no neutralizing, due to the low reverse transconductance of the unit. That means the internal feedback is very low, even though the gain is high. Q3 is used to keep the current constant if agc is used. Agc would be applied in positive-going form to pin 5, if required, which is not the case here.

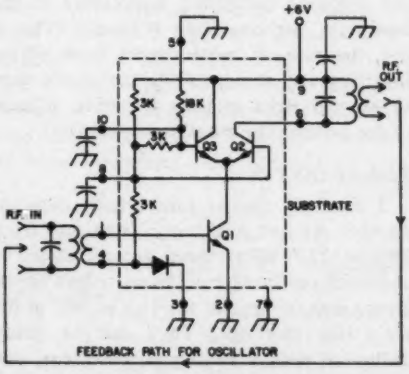

Fig. 3. Internal connections of the HEP590 and the feedback path used for oscillation.

Full gain is used by grounding pin 5. If you play around with it all, note that that pin 1 *return* must go to pin 4.

Operation

As usual, an oscillator should be running when you start to talk about it, so here we go. Referring to Fig. 2 and also to Fig. 3 for the internal workings of the 590, we see the 22.7 MHz signal entering the 590 on pin 1, the base of Q1. Here it is amplified, goes to Q2 for more amplification, emerging on pin 6, the collector, and from there on out to L3 and L6, which are also tuned to 22.7 MHz. Some 25 to 30 dB of amplification is available, and the feedback path from L3 through C5 to L1 thus takes only a small amount of the possible output power, which is not the case with many known oscillators, some of which use nearly all their entire dissipation limit just to maintain oscillation. This oscillator section, including the zener, should take about 5 to 6 mA. The value of C5 is quite important, and the needed value can be adjusted by varying the tap on L3. If C5 is connected to the high end of L3 less pF will be needed than in the indicated tap position, at 3 turns from ground. The overall phase is important of course, but shows interesting evidence of what may be called "phase-slip" as the ac around the total path C5-L1-L2-Q1-Q2-L3 and back to C5 finds plenty of places for incidental phase shift, both plus or minus. This is evidenced by the reversability of the connections to L2 without stopping oscillation. Connected in the best way, the operation is cleaner. This is not the case in most digital work where inverting and non-inverting inputs are seen to be very strict in their operation because of the dc type all-or-nothing operation.

Tune-up and Test

I used my regular tuned diode detector for this. As you go down in frequency from 147 to 22.7 MHz, these become easier to construct, as in Fig. 4. These things are of great value for crystal tune-up as well as for vfo's like this one. They can be easily calibrated with a $40 signal generator, one piece of test equipment you really should start with. There is quite a bit of adjustment to do between C4, C3 and C2, in order to

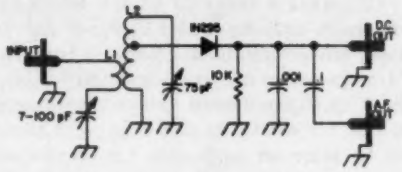

Fig. 4. Tuned diode detector (21–75 MHz) used for checking oscillator and doubler output. L1, 2T movable near L2; L2, 7T No. 3003 miniductor (16 TPI, 1.3 cm diameter), diode tap at 2T from top.

get the 1 MHz or 2 MHz spread out on the dial at 147 MHz that you are looking for. Also you may have to change L1 quite a bit. It's well worth it, though, because once you get it you can leave it, with slight touch-ups on C2.

Feedback

After a few adjustments on C5 you will soon get the hang of it. Too much feedback will cause too great a rise in milliamps in the 590. Too little feedback will result in weak oscillation. Just be sure and peak C6-L3 to the same frequency as L1. C7 will have an effect, though small, on L3, so it should be connected into the doubler which should be operating also. You can connect another tuned diode to the doubler output if you wish. I always do that, because as you jump around in frequency during the first tune-ups, you may easily hit an undesired harmonic and unknowingly stay there. The tuned diode detectors give you relative power and frequency at all times. Make sure of a good repeatable dial and mechanical stability before you start assembling and wiring.

Calibration

If you are in a region where there are plenty of repeaters, like here in Peterborough with Massachusetts, New Hampshire and Vermont mountains, and Connecticut hills, you can pick up ten or fifteen at almost any moment mornings and evenings, and will have no trouble calibrating the dial.

If not, start out with the indispensable signal generator, which should put you quite near 147 MHz, give or take half an MHz or so. You may have to find a friend who can help a little, with something on Two, and

then someone is sure to have on hand some old two meter crystals which can be put to good use to calibrate the dial, if by chance you live several hundred miles from the nearest repeater. (Just where would that be today?)

You will also want to spread 2 MHz, say 146 to 147, over the dial. This takes a little more doing, but with some frequency points found, a simple graph can be set up which will help, such as 146 = 15 on the dial, 147 = 91 on the dial, etc. At least one crystal probably came with your receiver, which will help, or you can order one on the frequency of your nearest repeater, and this crystal can be used later also.

Doubler

Most receivers use a crystal in the 45 MHz range, so you're most likely after a 45 MHz output here. There are a few receivers with 15 MHz rocks, Inoue and Standard for example, but most use 45 MHz. So a simple doubler as in Fig. 5 does the trick. An HEP 55 is used, but almost any 200 MHz NPN will do. A lead from C7 to the base of the 55 from C7 in Fig. 2 brings the 45 MHz in to the doubler. The collector goes to C1 and L1 in Fig. 5, with a tap on L1 and series C2 for the matching and loading of L1. Do not load L1 too heavily. If you use the tuned diode detector method you will be able to adjust this to the right point, which is a compromise between maximum output and maximum Q. You should be sure and have good tuning in order to boost the 45 MHz and drop the rest. Loading too much will not produce this happy condition. That's about it for the doubler. Be sure and use a diode detector to check on relative power while tuning up, and check the af to be sure noise is kept out. This doubler circuit is about as simple an rf circuit as can be found, so good luck.

Crystal Socket Adaptor

I expected complications when connecting the oscillator-doubler unit to the receiver crystal socket, such as self oscillation in the crystal transistor, with the crystal out, etc. Some did show up, but they were soon eliminated. After a few trials with tuned circuits and certain other methods,

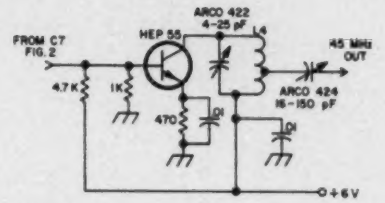

Fig. 5. Doubler for 45 MHz output. L4, 7T No. 24, 2.3 cm long, 2 cm I.D.

with self-oscillation showing up at times, I found the simplest way to do it. Figure 6 shows that (at least in this case) the simplest is the best. The two series capacitors C1 and C2 take care of any dc voltage wandering around between the units and eliminates self-oscillation in the receiver crystal circuit (from which the crystal has been removed, of course). Remember that a crystal is a "perfect" capacitor as far as dc goes, so there is no dc component to worry about. The crystal is often used as a dc blocking cap. My usual oscillators are almost always that way. Even in the good old days with tubes and a hundred volts or so, crystals were always good at blocking dc. After all, it's quartz, isn't it?

If you run the doubler output circuit C1-L1 in Fig. 5 with the cable output tap fairly high up on L1 you will get quite enough voltage at 45 MHz. The cable should then be as short as possible and run into the receiver crystal socket. I found quite a lot of leeway, with nothing critical encountered except if you get a little off frequency with anything open, such as receiver with top open or unshielded wires, you will hit commercial FM stations on 99.3 MHz. This is the 22.7 MHz energy times four doing its job. With everything buckled up, only the

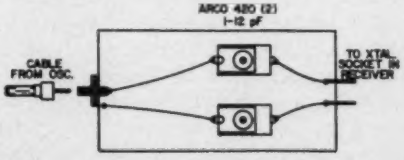

Fig. 6. Adaptor for connecting the 45 MHz output of the oscillator to a 2m receiver.

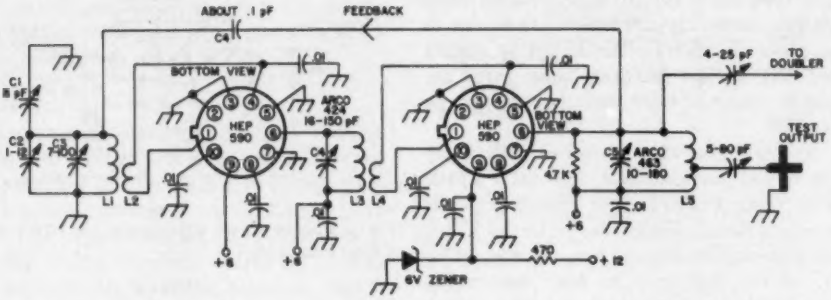

Fig. 7. Ultra-ultra stable oscillator schematic. This circuit offers superior performance over that of Fig. 2 due to the greater isolation between L1 and L5. L1 and L3: 15T No. 24, 1.2 cm long, 0.7 cm I.D.; L2 and L4: 1T at cold end (check operation with leads reversed); L5: same as L1 with tap at center. Isolate or shield L1 from L5. C4 is a piece of wire positioned near L1.

two meter stations are received. Figure 6 also shows the way the two caps are mounted, and the pins which take the place of the crystal pins. I didn't have a "dead" crystal, so I used the pins from an old seven-pin plug from the old tube days. It pays to have a large junk box. Mine has it's own bedroom! The pins of the crystal used in the receivers I tried were all .040 OD. I imagine sets of pins spaced, in a header, are readily available but I have not checked on it.

Ultra-Ultra Stable Oscillator

This vfo is quite similar to the one described previously in this article, except for the use of two IC's instead of one. The purpose of course is to provide more gain and less feedback in order to have greater isolation of the frequency setting circuit L1-C1 in Fig. 7. This results in even greater stability than furnished by the single LC oscillator. Figure 7 will be seen to have only slight changes from Fig. 2. The coupling links are only one turn compared to the two turns in Fig. 2, and C4 is a gimmick about 1/10th of a pF. Also, L1 must be well isolated and/or shielded from L5, due to the large gain involved in the use of the cascaded 590 stages.

The doubler to be used can be the same as in Fig. 5, and the same procedure for tuning up each doubler can be used. The same tune-up method as used for the single IC oscillator can be used for the two IC job. A little more attention must be paid because of the three tuned circuits to assure enough bandwidth as C1 is tuned. This whole circuit, having much more gain, can be broadened out in bandwidth a great deal by putting low ohmage resistors across L3 and L5. You can see a 5K already on L5. You can go as low as 300Ω or even less. At that value the tuning of L3 and L5 will be seen to be quite broad. An interesting method for tuning up L1, L3 and L5 is simply to hook a signal generator into L1 by a one or two turn link around it and tune everything to 22.7 MHz. Use the test output jack shown in Fig. 7 coupled to a tuned diode. Of course, remove the feedback line from L5 to L1 when you do this! This circuit is a good one for a 30 MHz i-f for 1296 and microwaves.

Conclusion

Two integrated circuit oscillators have been described which are suitable for use as tunable local oscillators for FM receivers which are presently crystal-controlled. The output, usually in the 45 MHz range, is plugged into any crystal socket of the receiver and allows tuning over the range 146 to 148 MHz. A two position switch, optional, may be used to spread 146 to 147, and then 147 to 148 MHz, over 95% of the dial, for greater ease of tuning and repeatability. The first oscillator uses one IC for simplicity, while the second uses two for greater stability. Although all construction here has been of the breadboard variety, the layout of the oscillators as described could lend themselves well to PC board construction.

...K1CLL

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A BASIC AMATEUR TV SYSTEM

ATV has become something of a step-child of amateur radio in the last couple of years, as least as compared to its younger sibling, SSTV. There are several good reasons why this has happened. First of all, it is considerably more difficult to get any kind of a signal at all on the air in the fast scan mode than it is with slow scan. Second, and more important, there never has been much literature available that dealt with the subject. Even the most recent ARRL handbook makes only casual reference to the subject, and refers the reader to one article, published more than ten years ago, that describes a very primitive system using equipment that is not readily available. *73* has published some good articles on the subject, notably those by Tom O'Hara W6ORG, but none of these has dealt thoroughly with the problem of getting a reliable transmitter on the air at a decent power level. It is my intent to remedy at least a part of that problem in this article.

In dealing with the problem of putting an ATV signal on the air, there are five things that must be given serious consideration:

1. Camera
2. Transmitter
3. Modulator
4. Antenna
5. Sound transmission

The camera doesn't present much of a problem. There are a great many of them on the market. If you don't like the prices you can purchase them in kit form or as surplus.

The availability of surplus FM equipment has helped greatly with the transmitter problem, but one most choose wisely in this area. I'll return to this subject shortly.

W6ORG has designed a couple of excellent video modulators capable of applying excellent modulation to practically any transmitter. See the bibliography, or write to

Tom. He has wired and tested units for sale at reasonable prices ($15 to $20). I'll return to this subject too.

Antennas can be a very sticky problem in ATV, because of the great bandwidth needed for a standard TV signal. Most hams tend to shy away from the yagi because of its narrow band reputation. Collinears are unwieldy and very difficult to get working properly. Oh, they'll do some radiating, but getting the currents in all the sections equal so that the pattern is predictable and the gain is what is should be can be a knot of Gordian complexity. The log periodic has its points, but it is difficult from a mechanical standpoint. The helix, also difficult mechanically, presents loss problems when working stations with uniplaner (I think I made that word up) polarization. Corner reflectors are huge and the gain is quite low in view of the size of the antenna.

So what do we do for an antenna? Let's take another look at the yagi. Our initial rejection of it was due to bandwidth considerations. In reality much of the yagi's "narrow bandedness" is due to the matching arrangement, rather than some inherent quality of the antenna. If we're willing to settle for an swr of something a bit greater than unity, but not so high that it would cause serious losses, the yagi will do an admirable job in ATV.

I have had excellent results using yagis made up just a shade shorter than the handbook dimensions (they're usually cut for 432, while in the Kansas City area we're operating at about 440 MHz) and using a folded dipole for the driven element. The impedance of almost every multielement yagi is in the neighborhood of 20Ω. The standard four to one folded dipole steps this up to about 80Ω. Coupling this to a 50Ω line through a bazooka easily made from aluminum foil and plastic tape results in a 1.6:1 swr. The swr on a 75Ω line would be less than 1.1:1. Another scheme is to stack two such antennas one wavelength or multiple thereof apart and run open line of not more than 1.25 cm spacing between them. Now the impedance at the center of this line will be about 40Ω, for an swr of 1.25:1 on a 50Ω line. This approach has been verified experimentally, and it works very well.

There are three distinct systems of adding sound to video in use among amateurs today, not counting just sending the audio on another band. Closest to the real thing, and most expensive as well, is to use a separate FM transmitter and antenna, 4.5 MHz higher than the video carrier. Some ATV enthusiasts FM the video carrier with audio, detecting the sound on a surplus FM receiver and feeding its first i-f to the TV set. This is a clever arrangement, but the FM receivers have terrible noise figures and limited bandwidth, making a poor TV converter, and the TV set will usually detect the audio as sound bars in the picture, if only to a small extent. The third approach is to use a subcarrier generator. Don't let the term intimidate you. It's just a 4.5 MHz oscillator with a simple FM modulator. Its output is fed to the video modulator along with the camera output. If the video modulator has the proper bandwidth capabilities, any ham who can receive your video will also copy your audio on his TV set. The bibliography gives an excellent circuit if you like to build from scratch. ATV Research has a kit available for less than $20, and W6ORG sells a wired unit for a few dollars more.

Now let's get back to the subject of transmitters and video modulators. Your best bet is one of the surplus FM rigs. They will all put out about 15 or 20W, and some can be made to deliver quite a bit more. You are most likely to encounter GE, RCA or Motorola rigs. The GE and RCA units are by far the easiest to work with. They use dual pentodes (5894's or 6907's) in the final. I don't recommend them. If that sounds a bit strange, let me explain. First, these rigs use tuned lines for the input and output. This system is horribly inefficent as compared to either the coaxial or strip line methods. Second, the screen grid must be bypassed for video, using an electrolytic capacitor in addition to the rf bypassing. Tuning for proper modulation is very critical and difficult to maintain. Worst, these tubes heat like crazy. I had a 5894 that melted the solder on the tuned lines after about five minutes of continuous operation.

The Motorola T-44 transmitter strip, although somewhat more difficult to rework

mechanically, makes a much better TV rig. It uses a 2C39 in grounded grid in the final. These tubes, with proper cooling, can dissipate 100W! With 1000V on the plate, it's not hard to get 50W of video modulated rf out of one of these rigs. The real disadvantage of the T-44 is that grounded grid circuit. Since the easiest method of video modulation is grid modulation, this poses a problem. Actually, the 2C39 grid is not grounded for dc. It is connected to a copper plate that is separated from the chassis by a sheet of mica. My grid dipper shows the value of this capacitor to be about 1500 pF. This value is large enough to bypass much of the video. Grid modulating the T-44 as it stands, I found that the frequency response began to roll off at about 1 MHz, and that it had cut off completely by 2.5 MHz. The video definition was poor, and the audio subcarrier wasn't there at all.

Happily there is a way out. Take the output cavity apart (easy), make a couple of narrow shims from an epoxy PC board to space the copper grid plate further from the chassis, and put it all back together (hard). I found that tacking all of the copper and mica and stuff together with a few dabs of rubber cement made it possible for one human being with two hands to put it together again. This operation decreased the bypass capacitance to about 50 pF. Anything between 30 and 100 pF should do.

The above modification makes the final somewhat prone to self oscillation when the video lead is connected to the grid, so some rf filtering is necessary. Figure 1 shows the circuit.

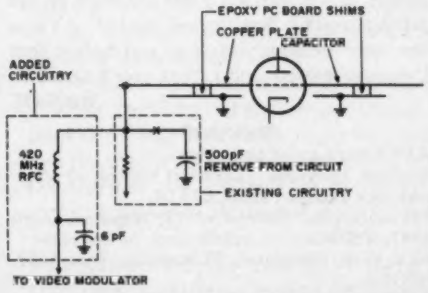

Fig. 1. Circuit modification of the T-44 transmitter strip to increase modulation bandwidth.

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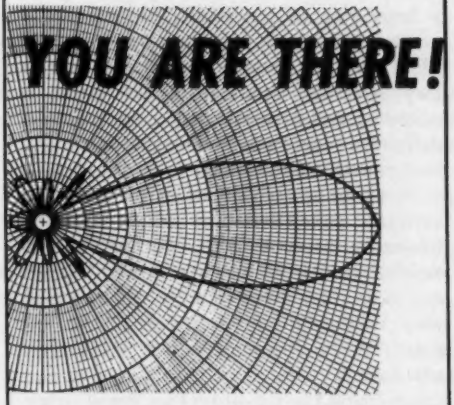

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I am using a slightly modified version of one of W6ORG's video modulators. The circuit given in the bibliography is a good one, but it is imperative that the lead from modulator to final grid be very, very short. This is difficult to accomplish with the T-44, so I used the two transistor version shown in Fig. 2. The second transistor is an emitter follower that lowers the output impedance so that a longer line can be used without degrading the video. It's still a good idea to keep that lead as short as you can.

The capacitor that bypasses the emitter of the first transistor in the modulator plays a large role in determining the frequency response. W6ORG suggests a value of 470 pF. I am using about 1500 pF. It is best to play with this value once the system is operational. Too small a value will limit the definition, while too much capacitance will lead to video distortion.

It is possible to put a signal on the air and carefully tune the final and adjust the frequency response of the modulator while another ham monitors your signal, but it's not easy. The strong local rf will overload your receiver so you won't be able to tell what's really going on as you make each adjustment. Your best bet is to use a transmission line detector (Fig. 3) and watch the signal on a monitor or scope. While not an absolute necessity, a wideband scope will save you a lot of trouble. I'm using an RCA TM-6C Master Monitor, a combination video monitor and waveform analyzer. I bought it for $50 from a local TV station, where it had been replaced by a solid state unit. Denson has surplus units, although their price is higher.

To put the system in operation, first get the audio subcarrier oscillator on frequency. Either feed the signal into a standard TV set

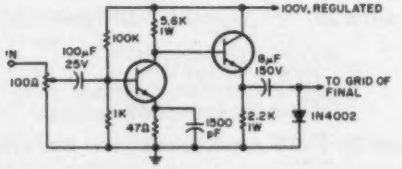

Fig. 2. Video modulator. Both transistors are RCA 2N3439 or 2N3440 with heat sinks.

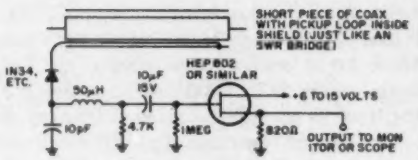

Fig. 3. Transmission line video detector.

just after the video detector, or use a general coverage receiver to set it at 4.5 MHz. Then set the level. With the TV set you should be able to hear the audio and adjust the level so the audio does not upset the picture. On a scope, the trace should thicken just a bit during the blanking pulses.

Now, connect the camera and audio unit to the modulator and fire up the transmitter. Tune for maximum output while staying within the tube ratings. Watch the scope or monitor as you adjust the modulator gain control. When you reach 100% modulation the top of the waveform on the scope will flatten out, and the whites in the picture will become washed out. Back off the gain control slightly. This is the time to play with the capacitor that sets the frequency response of the modulator. At the same time carefully tune the final around both sides of maximum output. The object is of course to get pleasing video and audio on the monitor, or on the scope, a pattern almost identical to that at the input to the modulator.

I have experimented with several ATV transmitting arrangements, and the system I've described, using the Motorola T-44 transmitter strip, out-performs the others by a considerable margin. I suggest that you read as much of the material in the bibliography as you can get your hands on before getting started. But do get started. ATV is the most exciting aspect of our hobby that I've encountered, and I think you'll agree.

. . .WBØFQF

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MAXIMUM PERFORMANCE FOR SMALL YAGIS

A grid of small dimensions in place of the usual parasitic element will increase both gain and F/B ratio.

Many hams face the problem of constructing an effective low band antenna within a limited space – the roof of a row house for example. Long Yagis are clearly ruled out, and cubical quads are not without their disadvantages. However, by a simple adaptation of the screen reflector principle long in use in amateur VHF work and currently popular for UHF TV reception, the performance of a larger array can be approached.

The Problem

The trouble with all (particularly small) parasitic arrays is that neither forward gain nor front to back ratio can be maximized independently of each other, or of useful bandwidth either. Use of a screen reflector element of moderate size as described below will permit the user to obtain close to the full theoretical value of gain, and better F/B ratio than can be realized with a single parasitic element in its place. But does a decibel more off the front and a few less off the back really matter?

I believe it does. Particularly in the amateur service – where power input is limited by law, and contacts are by chance and the vagaries of the ionosphere. The *radio transmission loss* (defined as the ratio of radiated power to received power) typically observed in long distance communication is tremendous. Suppose your good friend in QZ9 land is putting a modest two hundred watts into the aether, and one microvolt of it finds its way into your receiver.

By $P = E^2/R$, that's a meager fiftieth of a microwatt, or 160 dB less than came out of the transmitting antenna. When conditions are marginal, or the competition fierce, it is then that the extra care paid to, say, using RG-17/U (low loss) instead of RG-58/U, Type N (constant impedance) rather than UHF connectors and other "small details" pays off.

Every decibel counts. As applied to antennas this means the best gain and F/B ratio available per usable area. But a limited space ham need not settle for a limited performance antenna.

A Solution

An ideal (infinite) screen reflector antenna has the basic properties summarized in Fig. 1. Thanks to the inverse square law, among other physical phenomena, a practical reflector can be made relatively small in terms of wavelength and yet be nearly as effective. Moullin has shown both theoretically and by experimentation that there is

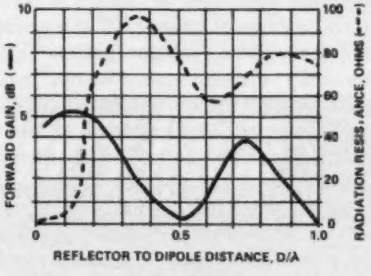

Fig. 1.

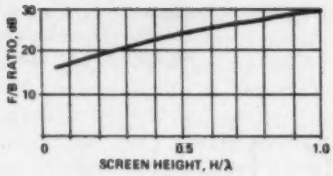

Fig. 2.

no substantial difference in performance between an infinite reflector and one slightly over 4/5 wavelength in height and 1/2 wavelength in width.

That's still fairly big for 15 meters, my favorite band. However, performance still drops off fairly slowly beyond this point. Figure 2 shows the variation of front to back ratio with reflector height for a fixed spacing of 1/5 wavelength.

Even so, one surely can't erect a large reflector made of aluminum foil! Theoretically, a parellel wire grid will appear the same as a solid sheet if the self inductance of the wires is equal and opposite to the mutual inductance between them. (The antenna is then properly called a grid reflector.) For small values of wire diameter relative to wavelength, the proper spacing of filaments is S = 15D/4, where S is the spacing and D the diameter of the wires, both expressed in the same units. Still, that's a might tight (and bulky) network.

Experimental Results

To determine the effect of increased failment spacing on performance, scaled down models for the 432 (3/4 meter) band were constructed. Because of the simplicity of the equipment employed only relative, not absolute, field strength measurements could be made. Nonetheless, I have determined that regardless of wire size, interfilament spacings of about λ/40 of less result in the same polar radiation pattern as the theoretically dictated one. (Vertical radiation patterns could not be relaiably determined, however.) That pattern is shown in Fig. 3. It should be noted though that the tuning stub on the driven element had to be adjusted for minimum standing waves each time the spacing was changed, indicating slight impedance variations with interfilament spacing.

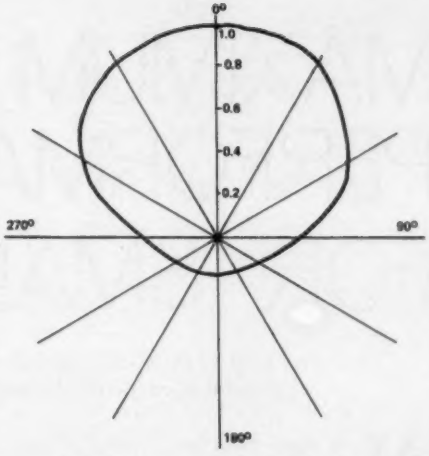

Fig. 3. Typical horizontal radiation pattern.

Construction Notes

My original antenna was a two element homemade 15 meter beam with the parasitic element tuned as a director and spaced 0.11λ from the driven element. A forward gain of 4 dB and a F/B ratio of 12 dB was realized; these figures can be taken as a typical compromise.

Two bamboo poles (chosen for lightness and cheapness, for this was just the prototype) somewhat over ten feet in length were mounted vertically on the ends of the parasitic element, now tuned as a reflector and spaced 0.15λ. See Fig. 4. Twelve lengths of #15 solid wire, each the same length as the relfector, were strung parallel thereto and spaced about ten inches (about λ/50)

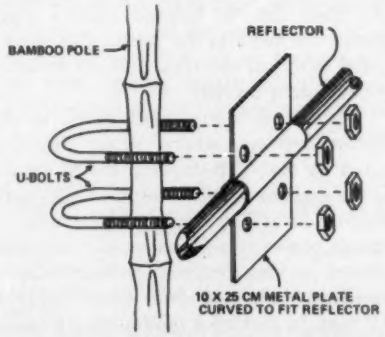

Fig. 4. Mounting of the vertical member on the reflector.

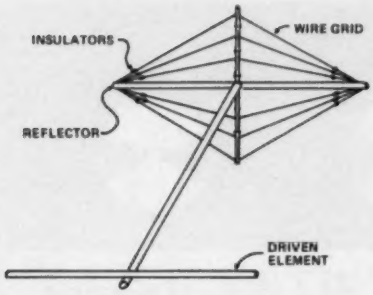

Fig. 5. Possible alternate configuration for lower frequency bands.

apart. The antenna was then raised to its original height of forty feet, with the point of support having been shifted considerably toward the grid.

Findings

On the air testing followed, comparing the performance of the new array with that of the dipole relative to which the original antenna was proved. Forward gain is in the order of 5 dB, and front to back ratio 20 dB. More subjective tests indicate that it compares favorably with a neighbor's commercial tribander for both short and long haul communications.

After successfully weathering a Philadelphia winter, the antenna was lowered for inspection and dismantled. New construction techniques are being developed for using this limited size grid reflector method on lower frequency bands. Shown in Fig. 5 is a sketch of the configuration currently under investigation for 20 meters.

For those many hams who, like myself, simply don't have the space available to lengthen their array, the type of antenna described in this article provides one further step toward full-size performance. Construction is simple, and the results are encouraging. Try it and see.

. . .WA3CXG

References

Henry Jasik, ed., Antenna Engineering Handbook, New York, 1961.

John Kraus, Antennas, New York, 1950.

E.B. Moullin, Radio Aerials, Oxford, 1949

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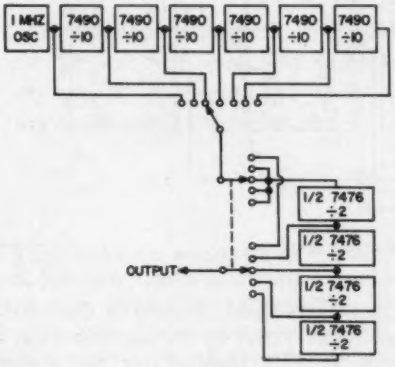

Fig. 1. Simplified block diagram of frequency standard.

and oscilloscopes. While my particular circuit used a 1 MHz crystal, there is no reason why a 100 kHz, 5 MHz, or other unit could not be substituted. The IC's in the circuit are suitable for operation up to 10 MHz. Selected devices may be satisfactory even up to 15 MHz.

Before presenting any detailed information it might be worthwhile to explain several points of interest about the circuit. First, the reader will note that the crystal oscillator circuit has been omitted. We assume that the average builder has a pet transistor oscillator circuit which he knows will work for him. Also, the circuit will depend upon the frequency of the crystal employed. Capacitor C1 was placed across the output of the unit to reduce switching noise appearing in the output waveform. For this purpose it works satisfac-

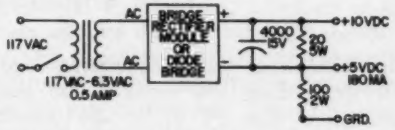

Fig. 2. 5V dc power supply using voltage divider network.

torily. However, in applications where high harmonic content is desired C1 should be removed. Notice that no output coupling capacitor or other means of isolation has been provided. This unit was to be used with

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1,000,000 Hz	500,000 Hz	250,000 Hz	125,000 Hz	62,500 Hz
100,000 Hz	50,000 Hz	25,000 Hz	12,500 Hz	6,250 Hz
10,000 Hz	5,000 Hz	2,500 Hz	1,250 Hz	625 Hz
1,000 Hz	500 Hz	250 Hz	125 Hz	62.5 Hz
100 Hz	50 Hz	25 Hz	12.5 Hz	6.25 Hz
10 Hz	5 Hz	2.5 Hz	1.25 Hz	0.625 Hz
1 Hz	0.5 Hz	0.25 Hz	0.125 Hz	0.0625 Hz

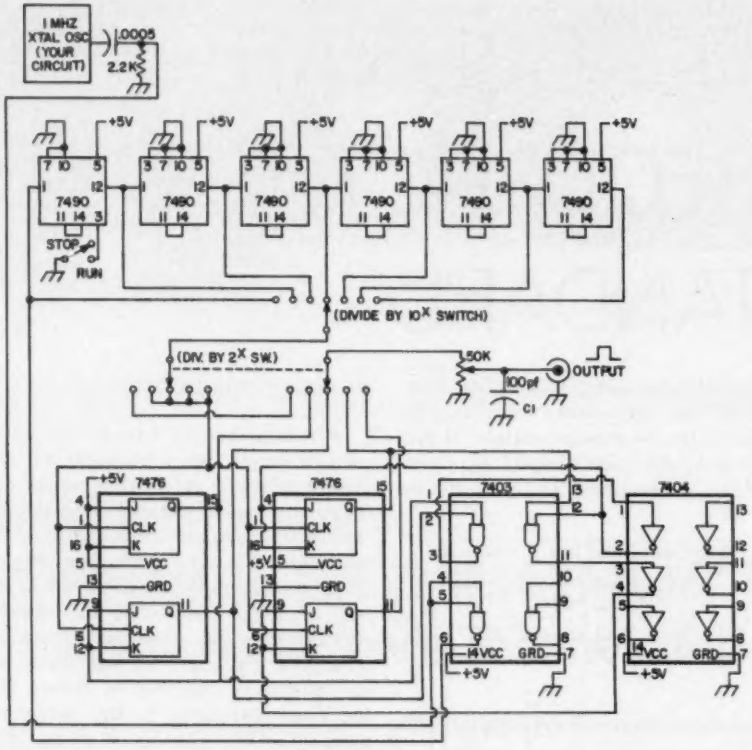

Fig. 3. Frequency standard wiring diagram.

other integrated circuit equipments and therefore nothing was required. Do not apply more than 5V dc to the output terminal at any time or destruction of the IC's will result. Some builders may require a more stable output voltage. The power supply shown is satisfactory for most applications of the frequency standard. A UA723 voltage regulator and pass transistor may be added, if desired, to yield a stable pulse amplitude.

If built as shown in the circuit diagram, the unit will produce a 2 volt square wave at the frequencies shown in Table 1. The accuracy of the higher frequencies will depend entirely upon how accurately you zero the crystal oscillator to WWV. A good idea is to listen to WWV on 25 MHz and work for a 25th harmonic zero beat, or as close as you can get. Back down at 1 MHz this will be a quite reliable signal. Division of the 1 MHz signal even further by the unit results in a highly accurate standard for the average amateur station.

All integrated circuit devices are 14 pin dual in-line packages except the 7476 dual J-K flip-flops which use a 16 pin package. A prototype printed circuit card for dual in-line package IC's was used for construction with wires run as shown on SK-3. Some builders may desire to fabricate their own boards and eliminate the wires.

Numerous modifications of the basic circuit are possible. In the interest of low cost and simplicity, most of the frills of commercially available pulse generators have been left out. What remains is an accurate source of frequency, TTL logic pulses, time interval markers, and audio.

...W4HSA

Mauran (Marty) Snow K1OZS
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A DIGITAL IDENTIFICATION UNIT

A TTL identifier that can be assembled, programmed and put into operation quickly. Adding a few components transforms the unit into a self-identifying electronic keyer.

The automatic generation of call signs is not new and a great many methods have been offered in the past. The older designs used often unreliable mechanical means, while most of the new electronic designs, although reliable, require several sheets of paper to figure out the programming. The unit to be described here uses state-of-the-art, inexpensive TTL logic and can be programmed in your head. To date nine units have been in use for almost a year in repeaters, RTTY stations, a CW station and a VHF beacon without any failures or wrong calls observed. After collecting all the parts and the PC board, the unit can be assembled, programmed and operating in less than 45 minutes.

How it Works

Chip U1 is a type 7400 quad two input nand gate. Sections a and b are set up in a free running multivibrator. Its operation is exactly like the transistor versions in the handbook. Pins 9-10 and 12-13 act as the bases and pins 8 and 11 act as the collectors of NPN transistors. The emitter is grounded internally. If the multivibrator should hesitate to run, momentarily connect a jumper between ground and the positive side of either capacitor. Because this circuit is ac coupled, it can turn on in a stable state. Once it is running, however, it won't stop until power is removed. Sections c and d are redundant and were used because they were in the chip and might provide some noise immunity. The clock pulse enters section c at pin 2. A control signal enters at pin 1. The control signal is a logic 1 (+5V) while the ID is running, thus allowing the clock pulse to exit at pin 3. When the ID is not running, the control signal is a logic 0 (0V) which closes the gate. This control signal is brought out on pin V along with its inverted function on pin U to control other low level functions that you might have need for. Section d is an inverter. The gated clock pulse enters on

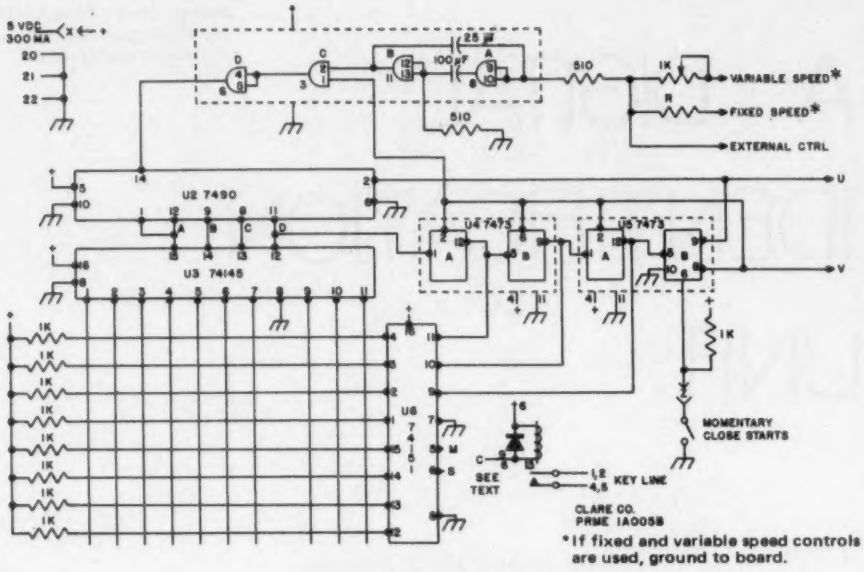


Fig. 1. K1OZS diode programmed CW identifier.

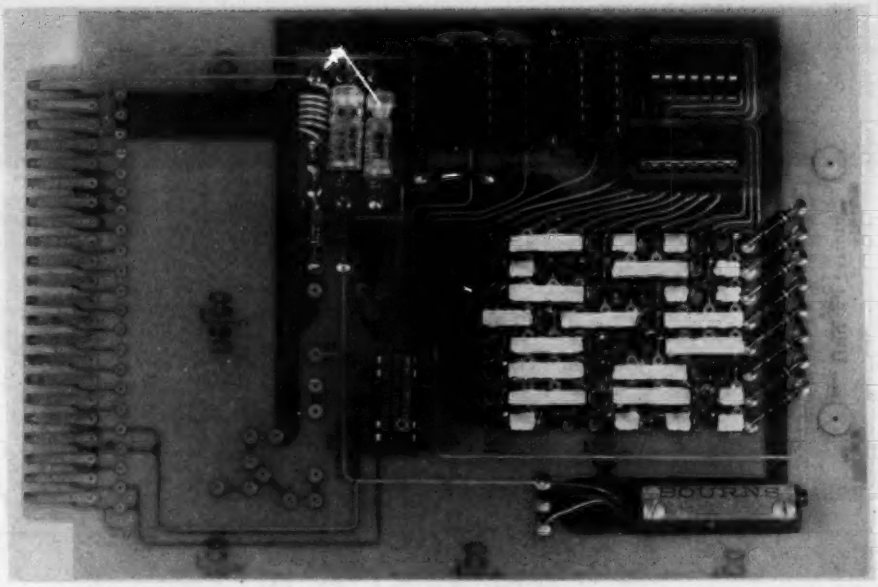
pins 4 and 5 and exits at pin 6 with the opposite phase.

Chip U2 is a type 7490 decade counter. Pin 2 is a reset to 0000 command. When it is at logic 1, as when the ID is stopped, the output count is forced to 0000 and cannot change even if clock pulses were applied. When the ID starts, the control signal goes to a logic 0 and the decade can count. Pin 6 is a reset to 1001. It is not used in this application and must be grounded. The 7490 is built in two sections internally and needs to be joined at pins 12 and 1 to get a decade count. When the ID is started, the clock pulse enters at pin 14 and the output counts in binary code, as shown in Fig. 2. Each time pin 11 goes from 1 to 0 it trips flip-flop U4. The four outputs from the decade counter go to the four inputs of U3, a 74145 one of ten decoder. The ten outputs of U3 are the collectors of ten NPN transistors, only one of which is on at any one time, that one being determined by the binary code at the inputs. If the input were 0000 and you were to measure all the outputs, you would find that pin 1 would conduct to ground and all the others would measure open. When the count changed to 1000 the on transistor would move from pin 1 to pin 2 and so on up to 1001 where the on transistor would be at pin 11 with all the others being off.

U4 and U5 act as an eight counter and control the start-stop functions of the ID. When the unit is at rest the outputs from U5b are: pin 9 = 1, pin 8 = 0. Pin 8 is the origin of the control function that goes to U1 and gates the clock. It also goes to U5a pin 2 and U4 pins 2 and 6, forcing the outputs of these flip-flops to equal 000. Pin 9 is the control function for the 7490 that forces it to 0000 output. Pin 6 of U5b is the reset pin and is connected to +5V through a 1K pull up resistor. If pin 6 is grounded for

pin	12	9	8	11
	0	0	0	0
	1	0	0	0
	0	1	0	0
	1	1	0	0
	0	0	1	0
	1	0	1	0
	0	1	1	0
	1	1	1	0
	0	0	0	1
	1	0	0	1
	0	0	0	0

Fig. 2. U2 7490 output.



Overall view of component side.

1 u sec. or more, U5b will reset, thus inverting its outputs. This removes the reset from U4a and b and U5a, allowing gate U1c to pass the clock pulses and allows U2 to count. Each time pin 11 of U2 goes from 1 to 0, U4a flips; each time U4a pin 12 goes from 1 to 0 U4b flips, which in turn does the same to U5a which eventually does the same to U5b as shown in Fig. 3. When U5b flips, the control signals change back and stop everything until U5 pin 6 is again grounded.

Chip U6 is a 74151, an eight channel multiplexer. It has eight input channels, any one of which can come out with the same phase as it went in or can be read on the other output pin inverted. What channel is on the output depends on the BCD code on pins 11, 10 and 9. If they equal 000 only information applied to pin 4 will appear on pin 5 and its inverted form on pin 6. All other inputs will be ignored. If the code changes to 11 = 1 and 10 and 9 = 0 only information applied to pin 3 will appear on the output and so on up to 11, 10 and 9 = 1 at which time only information applied to pin 12 would appear on the output. All inputs are connected to +5V through 1K pull up resistors to assure that they return to a 1 state quickly.

	U4		U5		
pin	12	9	12	9	8
	0	0	0	1	0 ID stopped
	0	0	0	0	1 start
	1	0	0	0	1
	0	1	0	0	1
	1	1	0	0	1
	0	0	1	0	1
	1	0	1	0	1
	0	1	1	0	1
	1	1	1	0	1
	0	0	0	1	0 ID stops

Fig. 3. U4 and 5 output.

The diode matrix is the memory and is read by U6 and driven by U3. Figure 4 shows a simplified version that will be easier to follow. It is read from left to right, top to bottom, just like a book. For an example, Let's program this small matrix to send dit dah dit dah. Before the start signal is given the ID is at rest and pin 1 of U3 is grounded because that transistor is turned on. Chip U6 is listening only to channel one on input pin 4 which is pulled up to a 1 by the 1K resistor. The relay is connected to +5V on one end and +5V through the chip and a 1K

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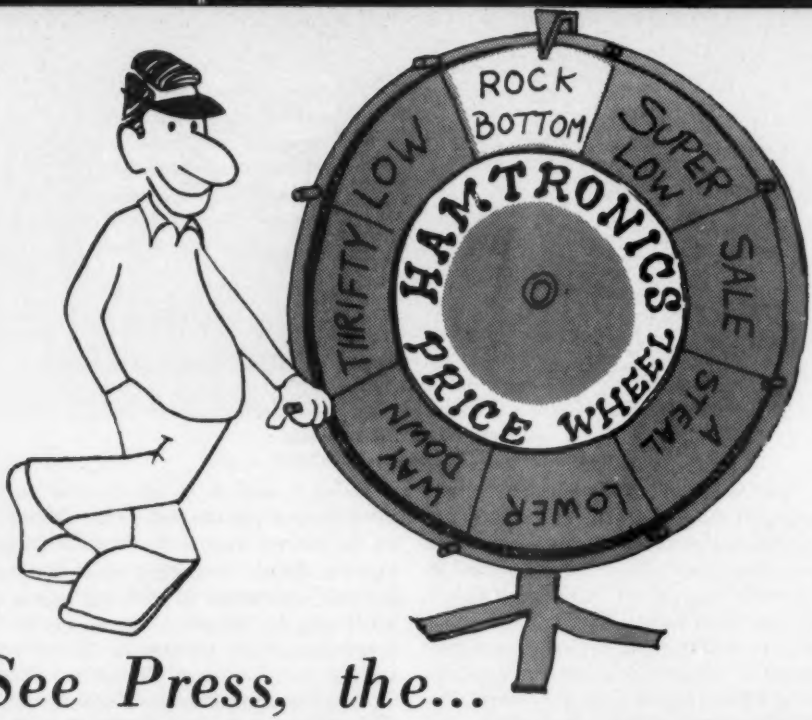

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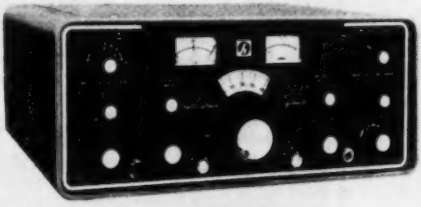

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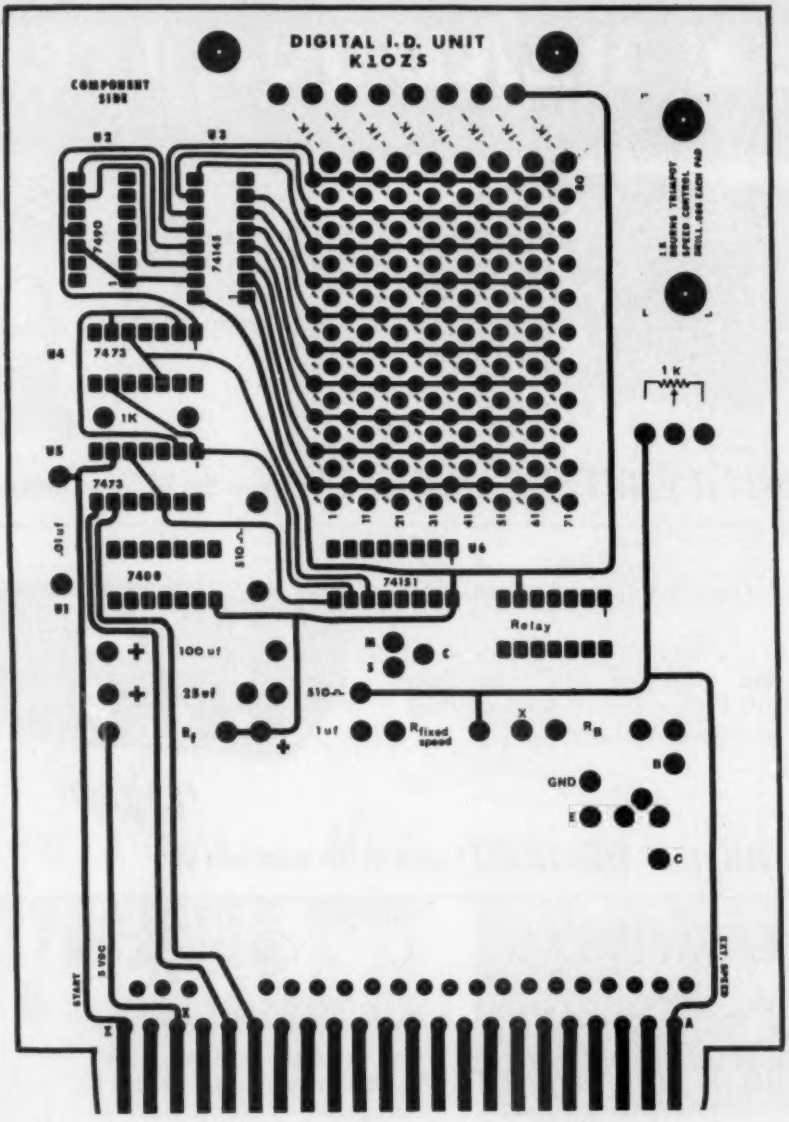
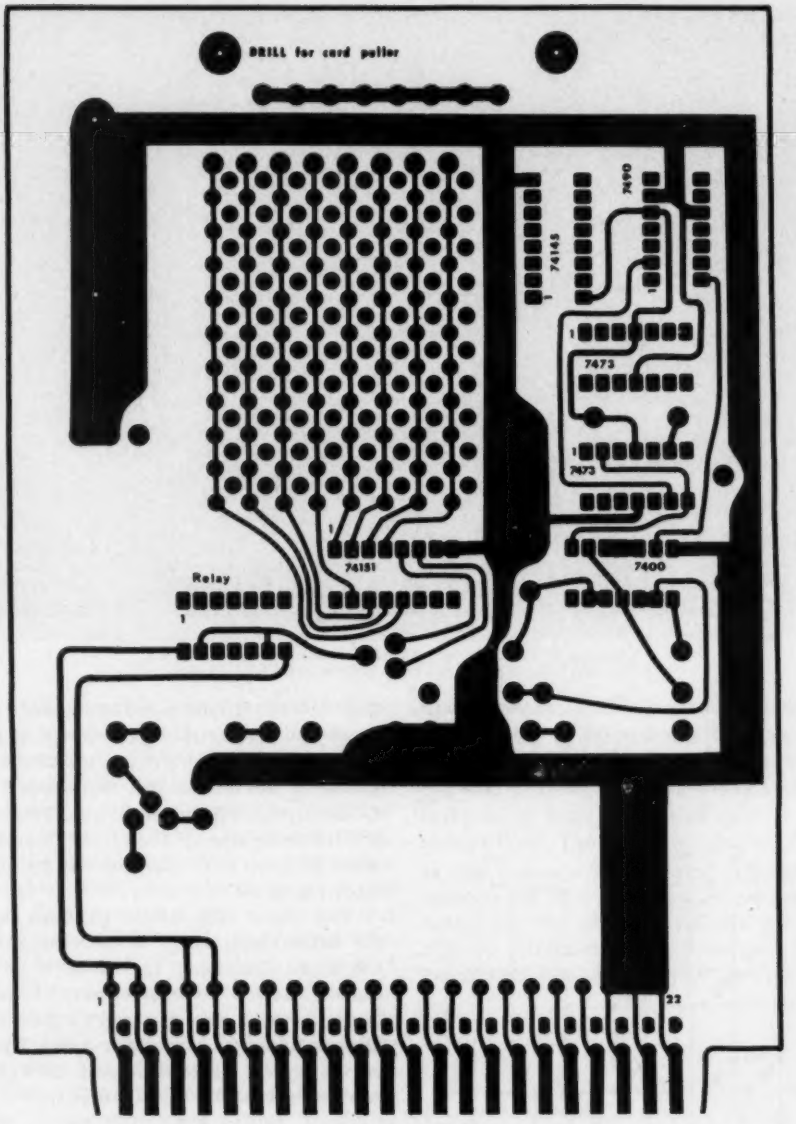


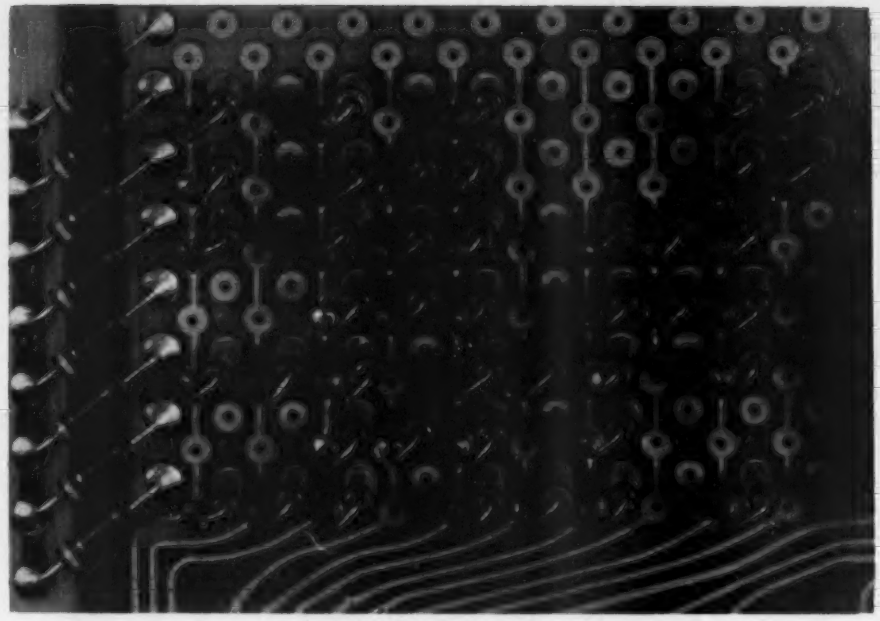
Circuit board, component side (full size).

resistor on the other end. No current flows and the relay is open or "key up." When the start signal is given the first clock pulse steps U3, T1 turns off and T2 turns on, grounding the line connected to its collector. Current now flows from +5V through the relay to D1 and ground, thus closing the relay. The second clock pulse turns T2 off and T3 on. Now no ground path is present for the relay and it opens, having completed the first dit of our character. The next clock pulse turns T3 off and T4 on, again providing the



Circuit board, reverse side (full size).

ground path and closing the relay. The next clock pulse turns T4 off and T1 on. When T4 goes off it steps U4 which advances U6, so it is now listening only to signals applied to pin 3 which in this case is grounded through D3 and T1, which causes the relay to remain closed. Because of the speed of the switching, the relay doesn't get a chance to open while U6 is changing channels. The next clock pulse turns T1 off and T2 on, so the relay still conducts through D4. The next clock pulse allows it to open. The



Close-up of matrix programmed for mark to send WA1OMS.

remainder of the matrix is read in the same manner until it gets to D8, at which time the relay is conducting. The final clock pulse turns T4 off and T1 on. When T4 goes off it trips U4 which returns U6 to channel 1, and sends out the control signals which stop the ID. As you can probably see, if a diode were placed at the intersection of U4 pin 1 and U6 pin 4, the relay would be on even though the ID were stopped. Therefore this position must be open or it will keep the key down when not in use.

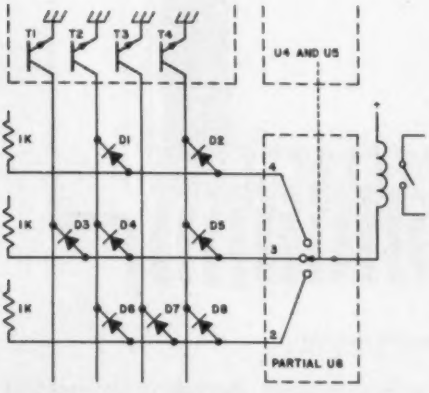
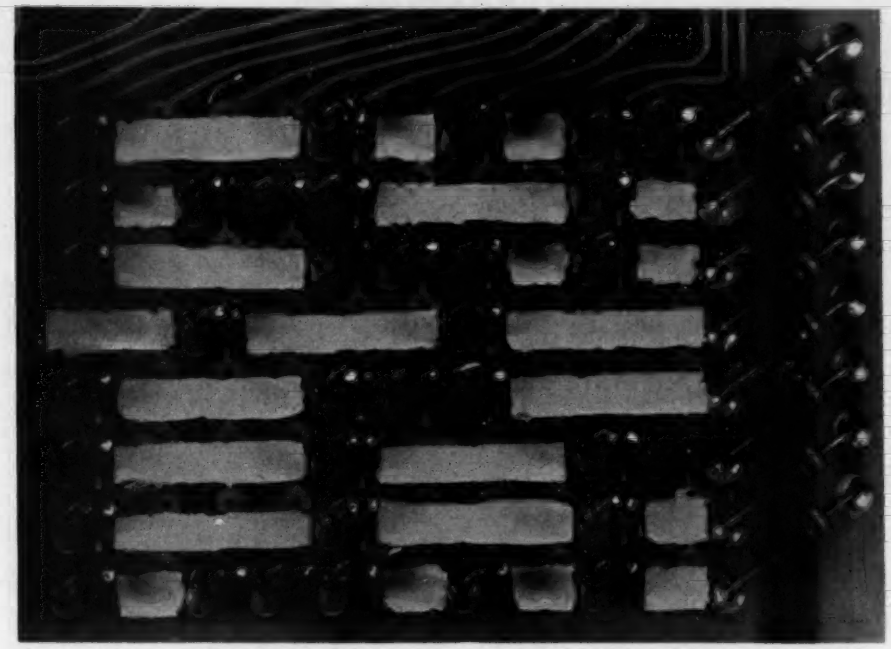


Fig. 4. Simplified version of the matrix. It is read from left to right, a horizontal row at a time, and is programmed to send dit dah dit dah. D1 is the first dit, D2, 3, 4 is the first dah, D5 is the second dit, etc. The blank areas between the bits are spaces.

The output relay used is the same size as the other chips, and it is sufficient to key the audio line from an oscillator or grid block key a low power transmitter. If higher power is to be keyed, a larger keying relay must be used with a transistor driver. Printed circuit for the driver and room for a larger relay are provided on the PC board.

Programming

There are two ways the diode matrix can be programmed, mark or space. Mark programming is like that described above in the small example matrix. Diodes are placed where you want the relay to close. To get a dot, use one diode, for a dash uses three diodes in a row. Spacing between dots or dashes in the same character is one space and



Close-up of matrix programmed for space to send deK1OZS.

between characters it is three spaces. When marks are programmed, connect the low side of the relay marked as C on the PC board to M which is pin 5 of U6. Because U6 also has an inverted output it gives us the option of programming for space. To do this simply put the diodes everywhere you would not put them when programming for mark, and leave them out where you would have put them when using mark. Connect the relay terminal marked C to S, which is pin 6 of U6. Note also that when programming for space a diode must be included at the intersection of U3 pin 1 and U6 pin 4. The capability to choose which way to program is handy if you are short on diodes, as one way usually uses fewer diodes. To decide which way to go, write your call out in code as in the example . – . – and count up the number of diodes needed for mark. One diode for a dit and three for a dash. In this case we get eight for this one character. If the number is forty or less, program for mark; if it is over forty subtract the number from eighty and that is the number of diodes to use to program for space.

Construction

The value of all components are marked on the PC board so placement should be no problem. The chips should be mounted in sockets, but may be soldered in if you are sure of them. The best type of socket to use in this case would be Molex pins because unless your PC board has plated-through holes, the pins must be soldered on both sides if a track comes to that pin on the component side. The board I used did not

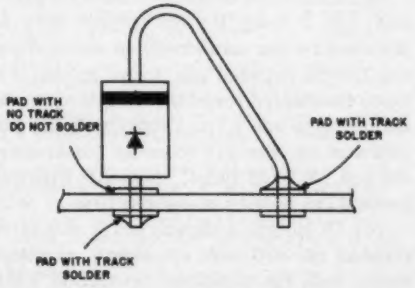


Fig. 5. Method of mounting the matrix diodes.

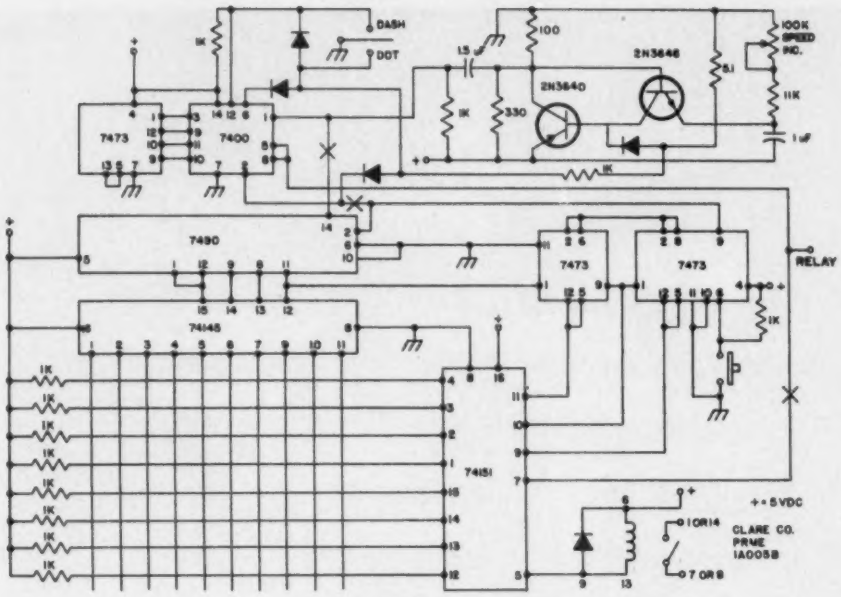


Fig. 6. One chip and two transistors add an electronic keyer to the ID unit at the three points marked with an "X."

have plated-through holes, and I didn't have any Molex pins. I found that by elevating the socket with a piece of board and bending the iron tip, the pins could be soldered without much difficulty. Solder the component side first so the joints are reheated when soldering the back, thus reducing the possibility of a cold solder joint. The diodes are mounted as shown in Fig. 5. All diodes used were 1N277 but many diodes were tried and they all worked. The card plugs into a Vector #980 socket.

Three methods of speed control are provided: (1) a small Bourns trimpot may be mounted on the card or (2) an external pot can be run between pin Z and ground. (3) Once the desired speed is found, the pot can be measured and a fixed resistor chosen and mounted on the PC board at the location marked "R fixed speed." No more than one method can be used at any one time.

No 5V supply is shown, but it should be capable of 300 mA. A simple regulator works well. For additional protection a ½A fast blow fuse followed by a 6V zener to ground can be used. If the power supply should go above 6V the zener will draw enough current to blow the fuse.

Other Applications

To make the ID useful to the CW station, one chip, two transistors and a few components need to be added so it includes an electronic keyer. No PC board has been laid out at this time, but the schematic is included in Fig. 6 for those who would like an electronic key that at the touch of a button would send out their call at the same speed the electronic key is runing! Note that when using this schematic the matrix must be programmed for mark. The circuit may be broken at the points marked X, and you have a TTL version of the W9TO keyer.

Circuit Boards

Etched and drilled double sided circuit boards for the digital identification unit described in this article can be had for $8.95 postpaid from MFJ Enterprises, P.O. Box 494, Mississippi State MS 69762.

...K1OZS

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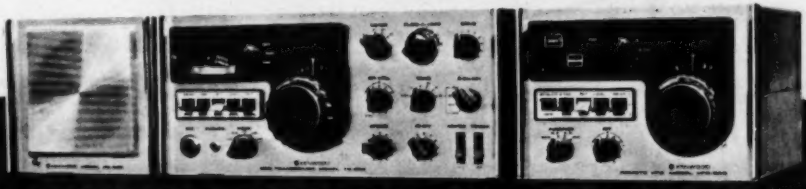

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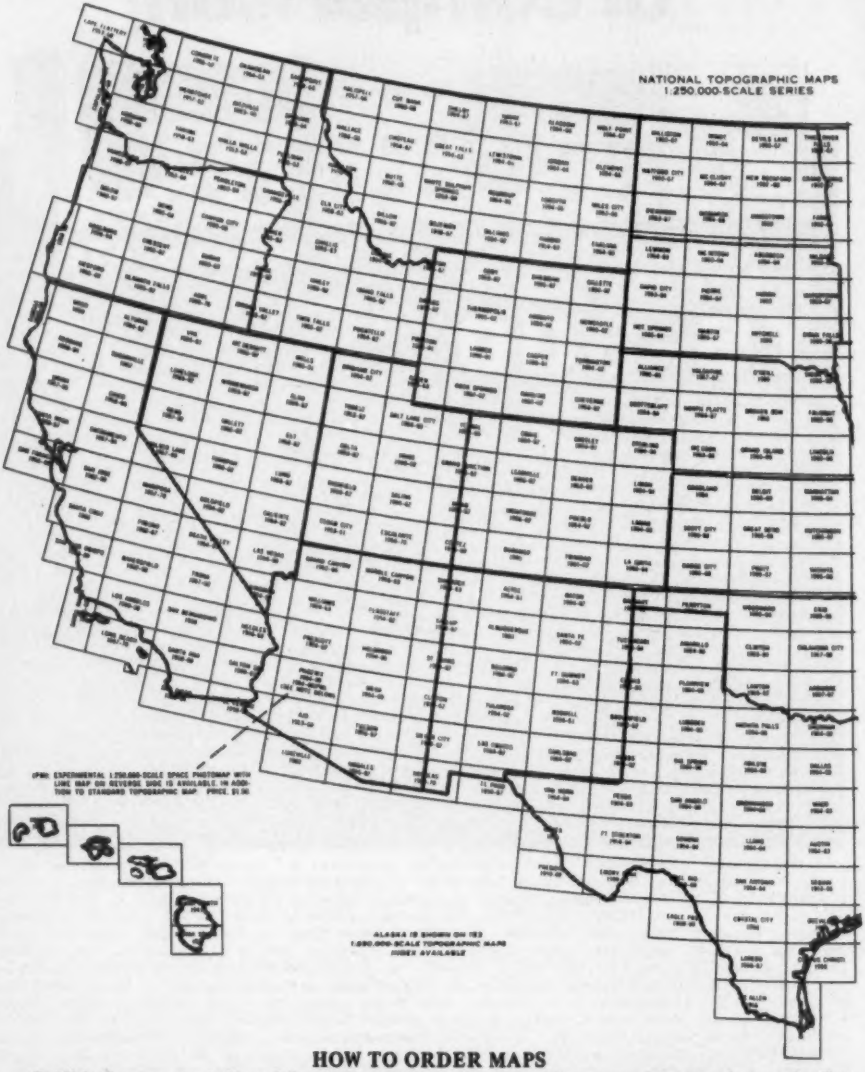

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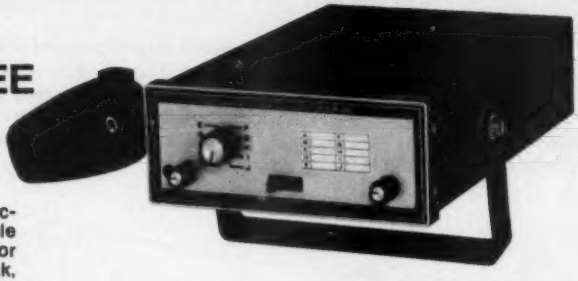

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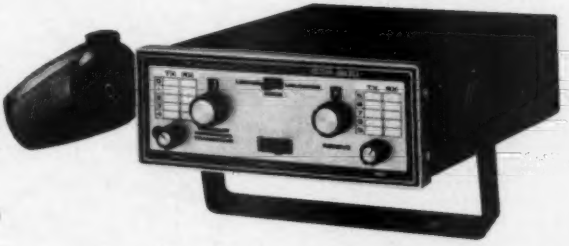

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MOBILE--AND DXING TOO

Say, have you been thinking about going mobile but have been putting it off thinking possibly the cost wouldn't really warrant it? Possibly you feel you're not really in the car enough to enjoy mobile operation. Maybe you've heard it's too much of a disadvantage to make it worthwhile. Mobile hamming does have its advantages, though.

You can, for example, take advantage of a good location, like atop a choice hill in an extremely quiet place. And usually a DX station will try a little harder to pull a mobile through to prove his rig is top-notch.

If you're running mobile now, you may not really be pleased with the way you get out. You say you're not working much DX mobile? Afraid to get in the pileups or go after the semi rare "goodies?" Well, read on, amigo.

Let's take it from scratch and assume you have the bare essentials (an auto and the desire).

If you want an inexpensive rig, you can pick up one of the used single-banders for under $100; the popular Heath power supply will power practically all the medium power transceivers. If you want to roll your own power supply, Triad's TY series of toroids are very nice and come with a complete schematic packed along with them for typical power supplies. If you are really gung-ho, uncased toroids are quite plentiful these days. There have a been a number of articles on using these in dc power supplies, so it won't be covered here.

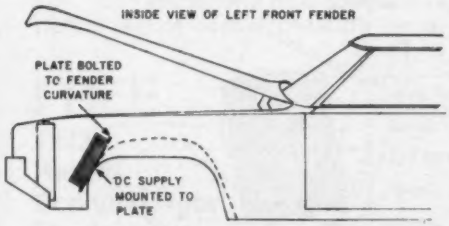

Fig. 1. Power supply mounted against metal car body for maximum heatsinking.

When you mount that supply, remember to put it under the hood against a flat surface to dissipate the heat into the car body. If your fenders don't have a flat surface, use a Seezac plate mounted onto the curvature of the fender, and mount the supply onto this.

Bonding is important, not just to eliminate ignition noise, but to give a more uniform ground and thus a lower swr. Using heavy braid, such as the shielding from a length of RG-8/U, ground the hood on both sides near the windshield at hinges to body, motor front and back on both sides to body, tailpipe in at least three places to body, and trunk, both sides at hinges to body. Be sure to put braid under the bolts in all cases for a solid contact – and for pete's sake, ground the mobile rig to the car body.

Antennas

The antennas manufactured today are much better than the old "whips," and it's well worth the cost to invest in one of the new chrome jobs; again, if you want to try a dandy antenna, why not a phased pair? Use two identical antennas and mount as far apart on rear deck or bumper as practical. Feed each with equal lengths of transmission line (50Ω, like RG/8U or Belden's low loss 8214) spaced on each side of the car (length is approximately 640 cm). Terminate each in a PL-259 at rear of rig and use a tee connector (Amphenol 831T) for connection to the rig (see Fig. 2).

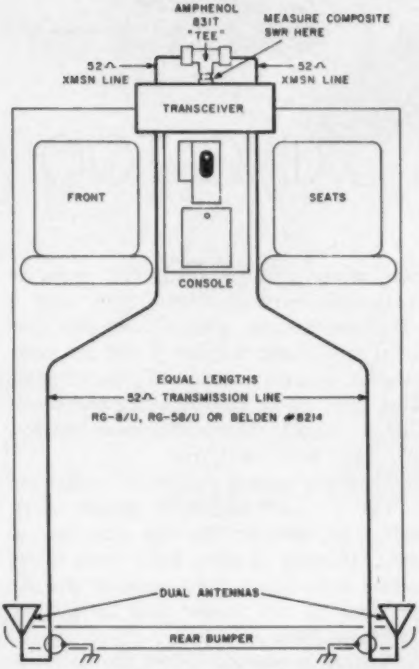

Fig. 2. K4TWJ's phased mobile verticals.

The swr is worked out by connecting each antenna, one at a time, to the rig, trying to get each swr as low as possible, then connect the two into the tee and measure the composite swr between tee and rig. This little system has worked quite well for me, and I have even tried adding a quarter wave to one leg of the feedline to change directivity. When doing this be sure to remember the one quarter wave also has to take in account velocity factor of the coax, thus one quarter wave X velocity factor of coax = actual length. The only problem with phasing is that it makes the antenna system basically a single band job whereas feeding both in phase will work all bands. Naturally the system is at a disadvantage due to the close spacing, but it still gives good gain. Of course, the antennas will work better on say 10 meters than on 80 meters; but even on 80 meters it will surprise you.

If you're running mobile at all be sure to throw in a compressor. This will prove to be your best dollar-for-dollar investment for the mobile rig. A compressor very often makes the difference on those DX QSOs. I have yet to find a time my compressor didn't give me at least a 5 dB gain and often up to 10 dB gain. I've found most units very nice and fairly inexpensive, but for the homebrewers there is usually a good compressor circuit in practically any ham magazine you pick up. I keep mine between the bucket seats so it is ready for those DX QSOs.

If you would like to know what it's like "being DX" or to be on the other end of a pileup, try the county hunters nets while mobiling through those off-beat counties; but be prepared – sometimes the pileups get heavy and it's up to you to handle things efficiently without letting the calling get out of hand. Good locations are on borders of two or three counties at one time, thus you pass out three counties instead of just one. These guys are usually sharp on QSLs too, sending you blanks to fill in and sign, so cost is nil for you. The CHs are on 20 meters and 40 meters every day and always listening for the rare mobiles.

Mobile Speakers

A speaker on the seat is handy when digging for that weak DX, but a bit awkward – first thing you know you either have the speaker to your ear or are leaning over like a typical drunk. I especially have a rough time because noise is extremely heavy in a convertible with the top down, thus the "DX Speaker" was born – the speaker (see

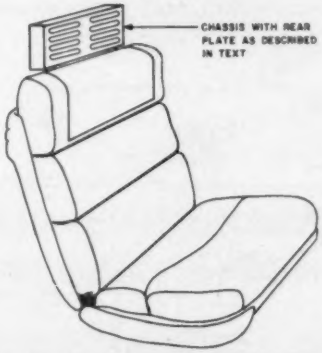

Fig. 3. Mobile speaker acts almost like headphones.

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Fig. 3) is made from an auto accessory "slip onto the seat" type of headrest, and a chassis. These slip-on headrests are readily available at most auto accessory shops and many large department stores. Since we don't use the top part of the headrest, only the bottom (the piece that slips over the top of the seat and has adjustable top extenders) a damaged headrest is the ideal bargain. Most stores will sell them for what they can get as it wouldn't be worth it to ship it back to the factory. I found a tan headrest with the top slit, and bought it from the manager for $1. Another dollar for a spray can of leather dye and it's black to match the car's interior. Now, measure for the "speaker cabinet" (chassis) leaving ample overlap for the mounting bracket. Drill the chassis in a pattern for the grille, mount the speaker, close the bottom (or rear) with a bottom plate and cover with vinyl to match interior. Now you have a fine looking speaker which, being right at your ear, is just like earphones. DX comes through like a pair of professional cans and with volume to spare when outside noises are high. (Stereo owners could put two speakers, one left and one right, rather than one in the middle, and wire it to their stereo).

Other Ideas for Better Mobile DX

Carry an ac supply in the trunk for those spontaneous portable excursions or when you are near ac lines. You would be surprised how often it will come in handy and give you a chance at DXing you otherwise wouldn't have. You don't need a fancy supply, just one from junk parts – mine cost $5 and will run any transceiver under 300W.

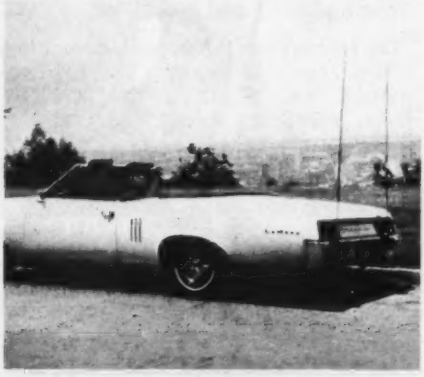
Next time you need a battery try the Delco Energizer group (used in police cars and ambulances, these batteries have a high ampere hour rating and are quite beefy).

Extra sulfuric acid is available from battery rebuilders and make nice, strong, healthy batteries out of the older ones.

Also, 24-hour clocks are fairly common for DX-minded autos. These 24-hour clocks are on deluxe models of cars and are usually interchangeable with the "economy" counterparts – for instance – the Pontiac GTO 24-hour clock and Pontiac Le Mans or Tempest are interchangeable. A salvage yard is an inexpensive source of these.

Most cars which have the antenna mounted on the rear have a slight gain over the right front fender, so try to face the car toward the direction you are calling. It's often possible to get a reflection off water towers or buildings for a little extra gain – by putting the car about 20–30 ft. from the water tower, with tower behind antenna, and car pointed toward station you are calling.

And, if you try CW mobile and don't have a CW monitor, try picking up your signal on the AM radio – usually I can get my keying with a fair tone toward the high end of the band (1400–1600 kHz).



Phased verticals are quite an improvement over a whip.

Procedures

A little finesse is in order when operating mobile – if you indulge in pileups. Be sure the word "mobile" makes it in during a lull in the pack calling. Often I find things like "Alabama mobile" followed by my call (which I know gets drowned out) catches the DX attention enough so they will give a special listen for me (this is when that speech compressor comes in handy).

So there you have it, and the next time business calls or your vacation falls unavoidably during the DX contest, at least all won't be lost, and you may soon find DXing mobile is not just a novelty. I still need things like YBØ VU and 9N1 mobile so the next time you hear me in a pileup give me a chance.

. . .K4TWJ

Ron Whitsel WA3AXV
209 Frog Hollow Road
Churchville PA 18966

450 MHz POWER DIVIDER

The 420 MHz band is a mecca for amateurs who wish to construct elaborate antenna systems without undue strain on both their pocketbooks and towers. A common method of achieving this goal involves the stacking of many smaller arrays to form one high gain antenna system. Such a system requires the effective and efficient distribution of arriving energy in order to fully realize maximum potential performance. This article describes a "power divider" which meets the above requirements and is easily constructed in the home workshop.

The design shown is for use with four identical 450 MHz antennas, each with a 50Ω unbalanced feed. The basic idea could be extended to other bands and impedance combinations.

Basically, the device is two parallel connected quarter wavelength coaxial transformers in an integral section of 50Ω coaxial line. Each quarter wave transformer steps the parallel combination of the 50Ω antennas (25Ω) up to 100Ω. The transformers in parallel then result in an impedance of 50Ω to match the transmission line. Figure 1 illustrates the basic arrangement.

Construction of the device is relatively simple and requires only a few basic hand tools, electric drill and a soldering torch. All necessary dimensions are given in Fig. 2. All joints are sweat soldered as you would do for any home plumbing job. The end caps and access hole cover are fabricated from copper flashing material.

One further caution comes to mind. If the antenna ends of the homemade hardline

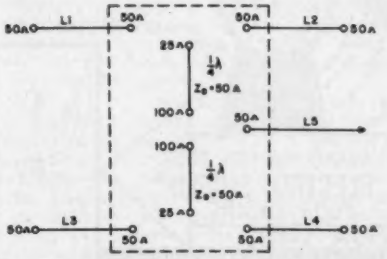


Fig. 1. Basic arrangement of the power divider. L1 = L2 = L3 = L4.

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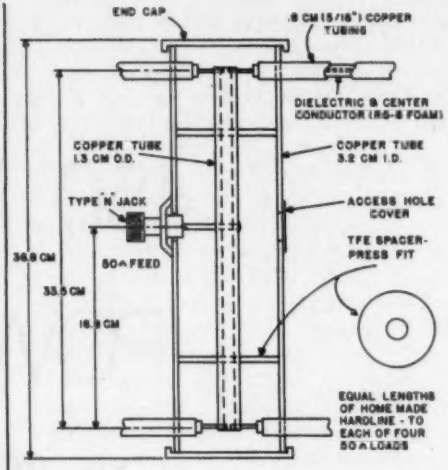
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EQUAL LENGTHS OF HOME MADE HARDLINE - TO EACH OF FOUR 50Ω LOADS

Fig. 2. Construction details of the 450 MHz power divider.

are to be exposed to the weather they must be completely sealed. This can best be done with silicone rubber, remembering to cover all the dielectric material projecting from the jacket. If a 4 to 1 balun is to be used, it can be made from the same material as the hardline and likewise carefully sealed. With a little imagination, ordinary type "N" plugs can be mated to the copper hardline if required of your installation. Also, K2KVT has developed a simple gamma type feed system which uses homemade hardline. The extension of the dielectric and center conductor, into a concentric metal sleeve, form the gamma capacitor. Food for thought.

This feed system is presently in use at my QTH with four commercial 8/8 slot-fed antennas. The installation is very neat in both appearance and performance and should remain so for many years to come. Keep in mind that the only really unique feature of this device is the construction technique. There are no expensive "N" connectors (except for the feedline) and the system is completely weatherproof. The homemade copper hardline is very low loss and will not contaminate nor degrade in performance over the years. Remember, a watt saved is a watt radiated!

. . .WA3AXV

FCC ROLE

An in depth look by
Wayne Green
W2NSD/1

Perhaps I am just too conservative for this modern progressive world, but my concept of the amateur regulations is that they should keep step with the needs of the hobby – not try to guess the future – and not fall too far behind. This is why I have on several occasions editorially suggested that some sort of yearly or semi-yearly convention for considering rule changes might be advantageous.

The recent rules seem to be written in an attempt to set up protection against some far distant future problems that amateur radio might have rather than meeting the exingencies of the present. Since few people have had any success in divining the future, I believe we have a right to object to Mr. Walker's attempts along this line.

The recent rules certainly appear to have little bearing upon any present problems as far as repeaters are concerned

Outside of a need to have the regulations catch up with the fact of repeaters, little legislation was needed to preserve order. Repeater councils had taken on the job of smoothing out our growth problems and the result was probably the least painful rapid growth in the history of amateur radio. I suspect that the main people crying for rules were those who were able to cooperate the least with our repeater councils. They probably wanted government rules to force others to accept their way of doing things rather than their going the way of the majority.

So here we are with repeater growth virtually stopped – crossband operation illegal – most experimentation either illegal or so bound in by paperwork that it is not worth pursuing.

Does anyone agree with me about the purpose of the FCC rules and changing them only when absolutely necessary?

The Paper Barrier

The new rules would seem to generate a barrier of paperwork fo the repeater group or even control operator who is anxious to abide by the book. For instance, as I read the rules, every time I want to change the location of my repeater I must file first with the FCC and await their authorization. It is not yet known whether this will require the usual $4 modification fee, but I expect it will. As the rules are written I would expect that even moving my repeater to another building a few feet away from its present location would require this application and fee and wait for Washington to act.

The 73 Radio Club repeater may be different from many others, but one fact of life for us is changing antennas. We try one for a week or so and then another . . . and another . . . and another. We've had over two dozen different antennas on the repeater in the last two years that we've kept track of. From now on we will have to file for a repeater modification for every antenna change – with a fee? – and await permission to make the change! Just moving the antenna a few feet higher is another modification – complete with filing, fee and wait.

Now let's say that the final amplifier goes out and we have to operate on reduced power. Is that legal? I think not! I think we have to file for a modified license, with fee, and await authorization. In the meanwhile we would have to stay off the air.

Each time a control operator moves, a new one is added, or an old one deleted, I believe this requires a modification of the repeater license, with fee, and wait for authorization from the Commission.

Now perhaps you think these license applications and changes are simple to apoly for. The fact is that some 500 repeater applications have been processed by the Commission so far and the last I heard over 90% of them had been rejected. Some day it may be relatively simple to apply for and get a repeater license – a control station license – or an auxiliary link license – but that day is not yet within sight.

Delays

And what about the delays. Our commercial brethren, who have been suffering under this type of paper blight for years, tell us that weeks and even months can pass before authorization is received. To get right down to the facts of today – we sent in a telegram requesting special temporary authority to operate a new repeater experimentally for one day. We followed this a few days later with a phone call and were told that we could expect about eight to ten weeks delay before getting an answer to our telegram.

You probably know that if you are going to become a control operator for more than one repeater that you must have a separate license for each – with, I suspect, a separate license fee.

And suppose you want to have a remote base station? This means that you must file for a remote control station as well as an auxiliary link station for your home location plus the remotely controlled station license and another auxiliary link station license for the remote location. You see it is illegal to talk over the remote control station! You use one station to turn the remotely controlled station on and off, and a second station

for the up link to talk through it. Let's see, at $9 each, that comes to four extra license fees, $36. And that is going up soon, right?

With each remote control station or auxiliary link station application you have to make a complete showing – systems diagram – bands to be used – monitoring provisions – power justification – measures to protect against unauthorized access – measures to protect against unauthorized operation – provisions for shutting the system down in case of failure – means of monitoring the link – and plenty etc.

Now do you see why this nightmare seems completely insane and why we put that logo on the FCC news section of the 73 newspages? Talk about Alice in Wonderland!

Some fellows who have pushed Mr. Walker say that he has relented on the control channel aspect of the above to the extent that he might accept a system which used just one 450 MHz transmitter for both control and auxiliary link, providing that different frequencies were used for the two functions. Got that? Talk about wasting channels! So what is wrong with using the link channel for control? Only that it is not legal. It is preferable that you use two separate transmitters.

Getting back, for a moment – at our repeater site we have three separate locations around the top of the mountain – a building with a 50 foot tower – a fire tower – and a small ranger shack. All have been used for repeater receivers at one time or another. We like to try split site and see what we can do with that – then try everything at one site with antennas on the top and bottom of the tower – then in goes a diplexer for awhile. From now on each of these changes will require pounds of paper – many dollars in fees – and eons of waiting.

We're tried the G.E. Progline gear at the repeater – we've tried Motorola gear – the Standard repeater – and even the Dycomm repeater (that's a whole 'nother story – and a grim one). We've tried small experimental repeaters – repeaters made from two transceivers – repeaters on 450 – on 220 – on 52 and even on 29.68 MHz. The prospect of continuing such experiments in the future is dim indeed – we just don't have the paperwork time and the patience to wait forever for authorization. I don't think we could even hack the license fees.

No Crossband

When the crossband restriction went into effect we decided that perhaps we would then have to go the remote base route. The fact is that after trying out twenty meter sideband via a two meter link we were agonizing over its loss. How can you even begin to express the fun of sitting at the big rig, talking through a hand unit instead of a regular mike – getting up – walking out into the yard – taking a mile hike – all the time continuing the 20m contact? Or walking out, getting into the car – switching over to the car rig – driving up to a nearby mountain – getting out and taking a nice hike up the mountain for exercise, talking all the while on 20m? Once you do that for a day or two you are hooked!

So okay – new regs – we can't use 2m any more for the remote operation. We can use 450 MHz now, right? Wrong. It seems that while it is legal to remotely control the 20m station via 450 MHz, it is not legal to talk over it since this would require an auxiliary link station and that cannot be mobile – only at a fixed land location. Damnation!

And what about our plans to get 220 MHz repeaters on the air, tied in with 2m repeaters at the start to help speed the opening of the band? All gone out the window – illegal. Not many mobile operators will go the 220 MHz route now. There isn't room in most cars for both2m and 220 MHz transceivers – and the investment for two makes it worse – plus the greater chances of being ripped off. Two antennas on the car should be quite a hoodlum magnet.

Please send a note of sarcastic thanks to Mr. Walker via your senator or representative. I may be overreacting, but this looks to me like the worst blow to amateur experimentation and development in the history of the hobby. I don't think I am over-reacting.

Six Control Ops

Now I hear that Mr. Walker has decided that a repeater should really have no more than six control operators. If any attempt is to be made to keep the repeater on 24 hours a day this means that each control operator will have to handle 28 hours each per week. That's okay for some – hard on others. And what happens when one or two are out of town on business or vacation? Then the average per week goes up to 42 hours each per week. That's a full time job!

No reason has ever been given as to why Mr. Walker wants repeaters to be turned off when there is no control operator actively monitoring. This requirement, if enforced, will require most repeaters to shut down during much of the night – and probably a good deal of the day. This means that as a safety or emergency service repeaters are going out the window.

There is no way to even estimate how many lives have been saved because repeaters have been there ready to use 24 hours a day. It is a fact that lives will be lost because of this regulation, if it is enforced. Each time such happens I suggest that those involved send a letter to Mr. Walker with copies to Barry Goldwater, ARRL, me, and President Nixon and explain that a life was lost – a loved one is dead – because Mr. Walker has insisted on asinine regulations which have no possible useful purpose.

And how many of you have run out of gas – had car trouble – or in some other way used a repeater late at night? The first time you need one badly – when some berserk gang of teenagers is chasing you down a back road and you need help and need it right now – and the repeater is off – please write about the situation and send those copies as above (if you survive).

Phone Bands

Mr. Walker's recent emasculation of the docket to expand the phone bands is another case where the work of years by many amateurs has gone down the drain – and for no apparent reason other than a whim on the part of Mr. Walker.

It was proposed to extend the 20m phone band down 50 kHz more. Any phone DXer who has been at all active in the last few years knows that this part of the band is little used and that continued lack of use will invite even more intruders. In my operations in rare spots I have noticed that the activity in the 14,150–14,200 kHz segment of the band is so low that it is difficult to make many DX contacts when operating there. As soon as I moved above 14,200 the action began – and that was not only to the U.S., but to all other areas of the world!

I realize that our Canadian friends would like to have this spot as a private preserve and that they will oppose U.S. expansion. But I think they will agree that with sideband there is little reason to have separate bands – and that virtually all DXing is done in the transceive mode these days. Most of the VEs seem to be right up there in the U.S. band when the DX is coming in anyway.

The General portion of the band is so crowded that it is often almost useless to even try to make a contact. This has come about mainly, I suspect, because all of the nets which were spread out over the band have now been compressed into half of the band. Nets must permit Generals to call in for it is the newer amateur who usually is more interested in joining them. By the time you have traffic nets, missionary nets, medical nets,

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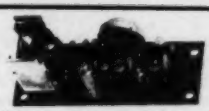

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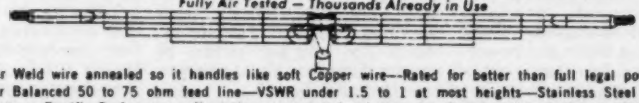

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A Personal Decision for Me

During the last two years I've watched with growing horror as the FCC has loosed a flood of asinine regulations. I've tried to talk with the man responsible for this, Prose Walker, but found him to be virtually impervious to reason or argument. I've been distressed by this since it was my concept that Mr. Walker was a public servant and as such should be working in the interests of those whom he purportedly is serving: the amateurs and the CBers.

First there was the Eyebank docket, 19245, which stressed the importance of not handling any traffic which could be of pecuniary interest to anyone. This was a completely new concept. In the past amateurs have been able to help reporters get stories from disaster areas — call in for a South American ham and find out what happened to an ordered piece of gear — things like that where the operator involved had obviously no pecuniary interest. But the new regulations are something else. We've yet had no interpretation of them, but as written it appears that it could be against the law to report an accident since this could mean money for the wrecker or a doctor or perhaps a hospital.

Then there is the environmental protection docket 19555. Some readers thought I over-reacted on the January cover to that. But here is what Bob Booth W3PS, the legal counsel for the League, had to say about it, "The proposed rule, if adopted and applicable to the amateur service, may be the greatest threat to the continued existence and growth of the amateur radio service in the United States since the proposal following World War I to abolish amateur radio entirely."

The crowning effort of Mr. Walker is the repeater docket 18803. Now, while I may have my areas of incompetence, no one can honestly call me dumb. Yet, all of the efforts that I have expended toward trying to understand the new repeater rules have brought only frustration and bewilderment. The more I ask questions, the more I seem to find that not even Mr. Walker understands what he has dreamed up for us.

To me it is a fact that we had about one thousand amateur radio repeaters active in this country before 18803 and they were all living pretty much in harmony with each other. Sure, there were little problems here and there, but for the most part these had been or were being solved by regional councils of repeater operators.

Amateur ingenuity was being demonstrated to an extent without precedence in our history. I've talked from a hand unit in Las Vegas via a ham network to a mobile in Los Angeles — to another in Phoenix — another in San Diego! It worked and worked well — and it is now absolutely illegal. This does not seem sane to me.

We had more and more groups experimenting with emergency systems of communications which permitted repeaters to be connected cross band to other repeater systems — to low band systems — to the service nets on 40 meters. We were starting to try out repeaters on ten meters so that we could interconnect two meter repeaters over thousands of miles in case of emergency. All this is now illegal.

To me it is a fact that the only emergency service which can provide short, medium and long range communications is amateur radio. It is a fact for me that every time there is a serious emergency the telephone system fails and radio is all that is left. Where will we be if the primary emergency radio service, amateur

radio, has its growth stunted by severely restrictive regulations?

I know it is not only me asking these questions for when I spoke to the FM gathering at Dayton I asked for a show of hands – first I asked to see how many of those present were the actual representatives of repeaters, not just users, but the fellows who have to license them and keep them on the air – I saw over 200 hands pop up. I then asked how many of those present thought that there was any way that they could manage to live with the present regulations – not one hand went up – NOT ONE!

We all know that our country depends upon us to provide communications when we have disasters and we know that the worse the disaster, the more amateur radio is needed. With CD virtually impotent, there is no other communications system except amateur radio available for the ultimate emergency. The repeater regulations, unless changed, could lose not just a few lives now and then when a repeater is off the air for lack of a control monitor, but could lose thousands upon thousands of lives because the amateur systems that we might have to meet the emergency will never be built.

Some amateurs seem to see a sinister plan in this – a plan to kill off troublesome amateur radio and get rid of it. I don't think so. I think we are faced with one problem: Mr. Walker. I suspect that he has worked up repeater regulations to fit the amateur experience in his past – for the regulations make sense if you think of them being written for 75 meter phone repeaters. Mr. Walker had had virtually no contact with two meter FM when he wrote those rules.

The ARRL is as frustrated as I am about what is happening. They have sent McCoy to Washington to try and reason with Walker – and he has gotten nowhere. The ARRL answer was to issue the sharpest denunciation of the FCC in the history of the League – and to start the directors arbund to the clubs getting the word to them about Mr. Walker. I have received tapes of some of these talks and I would appreciate getting tapes of others – my friends, please note. I wish that I had the space in 73 to reprint these talks verbatim – it might shake a few more amateurs into the realization that this is not something that can be shrugged off and left to someone else.

One director recently said that our representatives in the FCC have a responsibility to listen to us and have no right to ignore us or to retreat in petulance when we try to argue against new regulations. He was talking about Mr. Walker.

I gather that I have gotten on Mr. Walker's not too favorite list – if I may be guilty of an understatement. This is unfortunate, but I could not face myself or you if I did other than try to bring reason out of the madness that has descended upon us. I have not been able to achieve any reason. I now find that there seems to be a reluctance on the part of the FCC to provide information on the latest twists and turns of divination of the entrails of docket 18803.

Rather than getting repeater licensing information from the Commission I now find that I am getting some news from this club – from that club—from repeater newsletters – talks at conventions! This seems odd to me since I have tried to have 73 be as up to date on repeater info as possible and the Commission is well aware that they can get their information to the maximum number of amateurs if they provide it to the ham magazines – including 73.

In the past I have gone to Washington and talked with Mr. Walker and brought the results of this to the repeater groups via FM symposiums, the Repeater Bulletin and through the pages of 73. This has resulted in me becoming a sort of information center – with phone calls at all times of the day and night, letters by the gross, and even long visits from repeater operators.

All this has made it more difficult for me to work on 73 Magazine and, though some readers have gotten the impression that 73 is primarily an FM magazine, the fact is that about 20% of it is so oriented – and that is about right, considering the number of amateurs involved with FM today. I really should not spend as much time on FM problems as I have.

If the situation were clarifying, I might see some end to it. But it appears to be getting worse instead of better. If there were some way to talk reason with Mr. Walker, I might be encouraged. Reason in this case not being Wayne Green's ideas, but ideas agreed upon by most repeater groups. The League has the same problem and apparently hasn't figured anything to do about it either.

I am as upset as anyone when I hear about repeater councils deciding that if the FCC is going to ignore the needs and the pleas of the repeater groups, then they are going to ignore the FCC. The example of the citizens band is brought up constantly and amateurs ask why they should have to obey stupid rules when the CBers ignore virtually all their rules. This is difficult to answer.

It seems a pity that the amateur and CB division of the FCC should choose to ignore the CB problem entirely and spend all of their time dumping on the amateurs. Mr. Walker has a serious situation on eleven meters and this is his responsibility to solve – yet he appears to have come up with absolutely nothing to help this problem.

Getting things straight at the FCC obviously is important to more than the FMers – witness all of the other rules that have been coming out, none of which are much better than the repeater regulations. Really, before we turn to anarchy, we should make a determined effort to either break through the seemingly impervious wall Mr. Walker has built around himself or else work diligently to get someone else into his job.

Now I don't know if the ARRL is going to get to first base in their effort to unseat Mr. Walker. I suspect that they would make more headway if they concentrated on informing Senator Goldwater and the senate commitee that runs the FCC of the situation than trying to stir up grass roots reaction among the member clubs as they appear to be doing. Again, this would be ideal work for that Washington lobby that we don't have. I won't belabor that point further.

If I were to drop the reins at 73 and just concentrate on solving the Walker problem, I probably could manage it. I'd see every senator on the FCC committee. I'd try to get on television wherever I could and talk up amateur radio and point with anguish at the FCC – a posture that might be most acceptable to TV stations. I think I would interest a lot more people in amateur radio in the process and I think I could get Walker out as Chief. But the fact is that until quite a few more major manufacturers advertise in 73 and clubs get their members to subscribe to the magazine, I have to work my usual 90 hour work week just to keep our head above the water.

Of course I would enjoy talking up the hobby on television – getting to conventions for talks – putting on the pressure in Washington – I get a kick out of that now. I used to be scared silly to get up in front of large groups and talk, but now I enjoy it. It's fun to get across my ideas – to make everyone laugh – to entertain. I used to freeze up and not be able to think of anything to say in front of an audience – now I'm a bit tense, but my talks are unprepared other than for a note or two and I can go on for hours at a time – I haven't heard any complaints.

It is growing increasingly obvious to me that I must stop spending so much time trying to personally do something about the FCC in Washington. The ARRL has volunteered to get this

done and I probably would do best to sit back and let them do it and tend to 73 Magazine – make it better – help get more advertising – more subscribers – better articles – things like that.

It is difficult for me not to get wrapped up in new ideas. For instance there is the Repeater Bulletin. This was originally designed as a communications medium for the New England repeater groups to help them iron out their problems. Now, with but a few instances, these problems have been solved and we have about 50 repeater groups working in wonderful harmony. Obviously there is not a lot more need for the Bulletin.

Unless some important need arises for the Repeater Bulletin I think I shall spend less time on it – perhaps continuing it every other month – and work harder on 73. I did consider for a while the possibility of making it a newsletter for all repeater operators – but then I remembered how difficult it is now to get information from the FCC – or even from repeater groups. I'm not sure that a rehash of material from repeater group newsletters would be of much value – and it is expensive enough to publish a newsletter so there should be some darned good reason before going ahead.

Yes, I know about the reincarnation of RPT from the bowels of Dycomm down in Florida – I've seen the first issue with my good old buddy Rob Waters on the cover – and there is an interview with him inside where he admits to failing at manufacturing ham gear (remember the Waters switches?) – and says he thinks that the Class E CB band on 220 will be a good thing.

A good FM magazine could make it, I think – but one put out by Waters (who is not overly popular with many FMers) – Jim Penny of Dycomm – and Art Housholder of Spectronics would not seem to have much of a chance. I remember that Will Rogers said that he never met a man he didn't like – well I try to follow this ideal no matter how difficult the above three make my resolve. Seldom in my life have I been put to a greater strain.

Through the Repeater Bulletin I've tried to show what format would make an FM magazine successful – some articles – reports from repeater groups – FCC news – and lots of opinions and ideas. Any signs that the magazine is "owned" by one or two commercial interests will, I suspect, fold it the way this did rpt---. It just looked too much as if Dycomm and Spectronics were partners in the venture to sit right with other companies. The new RPT seems to be taking the same path, with the only major article being about a charger for the Motorola HT-220 and requiring a Motorola charger that is available only from Spectronics, to the best of my knowledge.

Speaking of the 200 MHz citizens band proposition – one further digression should be imperceptible after this long series of them, so let's air my views on 220 MHz – particularly since I have been misquoted and misrepresented almost universally on this subject.

It is difficult to speak of citizens band without bringing up the spectre of the present 11m band and the chaos present. It is all too easy to equate the mess with the term CB and dismiss the idea perfunctorily. I don't think it is fair. Eleven meters is the way it is, I believe, for two reasons – bad rules and little enforcement. If rag chewing and high power were permitted on the band I doubt if you would have illegal stations, bad language and all the other miseries. I am not suggesting such, only getting at the problems.

I do believe that there is a great need for an inexpensive communications band for small businesses – something like the original CB concept. I believe that there is such a need for this that even if it is not put in the 200 MHz band it will find a place in the spectrum. Obviously then there is a question, do we have anything better to do with 220–222 MHz than put in a small business band? I think we do.

It would be dishonest to say that I think that the present amateur population will move into the 222 MHz band in sufficient numbers to crowd the band. With the recent ruling against cross band operation I feel that the development of the 222 MHz band has been stabbed in the back. Mr. Walker, again. I expect there will be some development of the band, but I think it will be slow and frustrating. We don't have enough hams licensed now to even fill up two meters, much less 222 MHz.

If we were to start thinking in terms of trying to attract newcomers to our hobby – possibly looking to the Japanese system (they have over 350,000 licensed hams today to our 265,000) for ideas – we might take a band such as 220–225 MHz and open if for a special type of new amateur license – a band where newcomers could meet and talk with amateurs and be inculcated with the amateur spirit – where they could honestly have the fun of being hams and be encouraged to join clubs and get a higher grade of license.

A real beginner's license, similar to the one used in Japan, could well attract several million new hams. We could use them. And the 220 MHz band certainly could accommodate them. Figuring that they might spend only half the amount of money presently licensed amateurs do ($400 per year average), this would mean sales of about $200 million per year for each one million hams. This could easily grow to a market of $500 million per year.

Few amateurs are interested in the market dollars involved, of course, but this is the key to getting frequencies. The spin off for hams would be a return to growth of the hobby and a lot less chance of having further troubles from men like Mr. Walker. You've noted that he doesn't do anything to anger the 1,000,000 CBers, just the 100,000 or so active amateurs.

Thus manufacturers would certainly have their small business band, though it might end up in an unused television channel, complete with the $500 million per year in sales from that bonanza – plus another $500 million from the new ham band. Maybe more.

I had this scheme in mind several years ago when I submitted a petition for using part of the 220 ham band for a hobby class of license – one which would primarily require an exam on operating techniques and regulations rather than code and theory. It seemed like a good way to get fellows started the right way.

Frankly I think it is very short-sighted of the manufacturers who are backing the EIA plan for putting the CB band on the low end of 220 MHz rather than my hobby band idea – with a separate band for small business-type CB.

Every time I pick up a hand unit and talk through a repeater I get to thinking that it is almost unfair for me to have so much fun when it is prohibited to all but the handful of people who have passed the tough ham exam. I climb up my local mountain, FMH with Waller touch-tone pad gemounted in hand, and talk all over central New England – make phone calls in Boston – and I just know that this is something that could attract millions of people. Boy, if Walker knew how great a feeling it is to do that he might get rid of FM entirely!

Now, to backtrack through a few digressions, I think I'll leave Mr. Walker pretty much up to the League – and try to stop as much extraneous exercises as I can and see what I can do to get 73 into every active ham mailbox in the country. It's just too much for me to keep up with everything.

. . . W2NSD/1

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4. The cost and size of the components comprising the filter.
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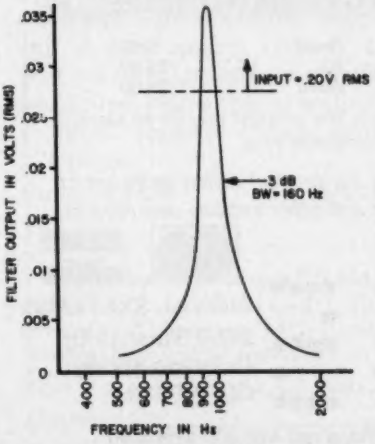

Fig. 1. Filter characteristics of the passive surplus range filter.

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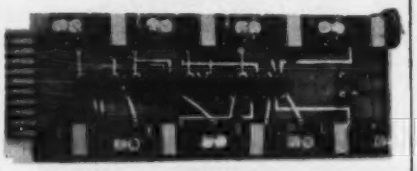

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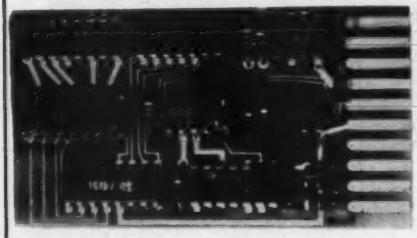

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6. The flexibility of the filter, i.e. fixed characteristics or variable selectivity, variable frequency or both.

The surplus range filter has been used by amateurs for more than 25 years. It is passive, plugs directly into the headphone jack, and inexpensive ($2.25). The characteristics of this filter are shown in Fig. 1.

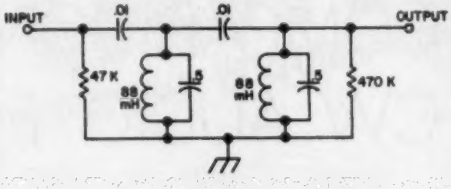
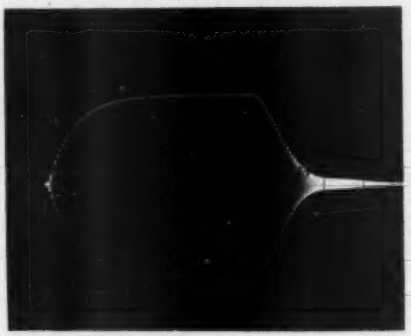


Fig. 2a. Schematic of the 88 mH toroid filter.



Horiz – 20 ms/cm, BW=35 Hz

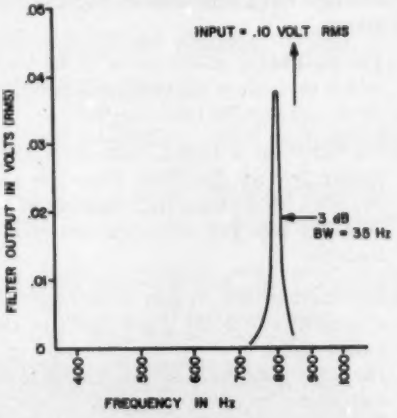


Fig. 2b. Characteristics of the passive toroid filter.

Horiz – 20 ms/cm, BW=142 Hz

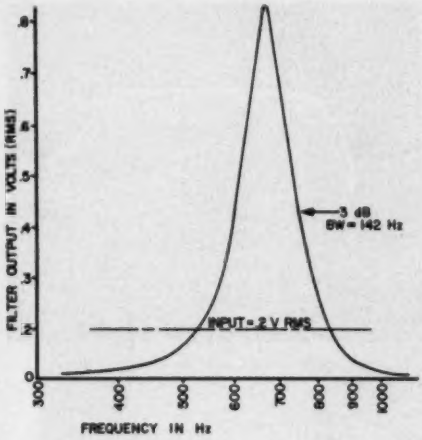


Fig. 3. Characteristics of the 4 section, Twin-T active filter (Ref. 2).

The insertion loss is high and the bandwidth fairly broad. The keyed wave form is sharp and CW signals sound good through this filter.

Figure 2b shows the filter characteristics of a passive filter design that has been popular for the past few years[1]. It uses inexpensive, surplus 88 mH toroid conductors. This filter is very sharp, 35 Hz bandwidth at 3 dB down, and it also has a high insertion loss. The keyed wave shape has a slow rise and fall so CW signals have a pronounced ringing.

Figure 3 shows the characteristics of a 4 section, twin-T, active filter[2]. This filter has been designed to provide a reasonably narrow bandwidth and a clean keyed signal.

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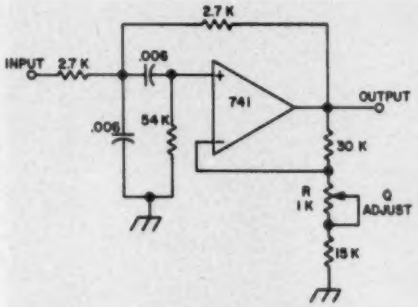
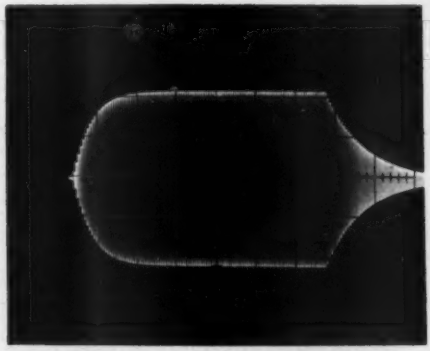


Fig. 4a. Schematic of the variable Q active filter.



Horiz — 20 ms/cm, BW=75 Hz

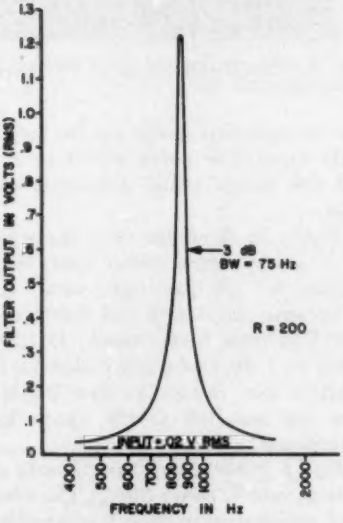


Fig. 4b. Response of the variable Q filter.

This filter provides signal gain and is fixed in frequency and selectivity. The design is fairly complex, requiring 9 transistors, 15 capacitors, and 30 resistors. CW signals sound good through this filter.

Figure 4b shows the filter characteristics of an active filter of fixed frequency but variable Q[3]. The keyed wave form is a slow rising and falling wave form, but its slope is good considering the narrow (75 Hz at 3 dB) bandwidth. The cost of the filter is low since 741 operational amplifiers are available for approximately 35¢.

Figure 5 represents a single active filter that has variable selectivity and variable frequency. The bandwidth can be made extremely sharp, less than 9 Hz, or very broad, greater than 300 Hz. The keyed wave

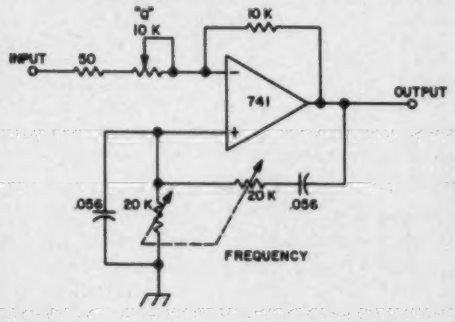
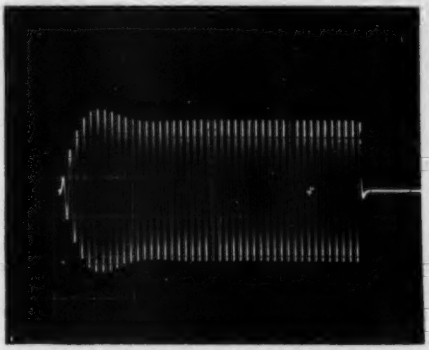
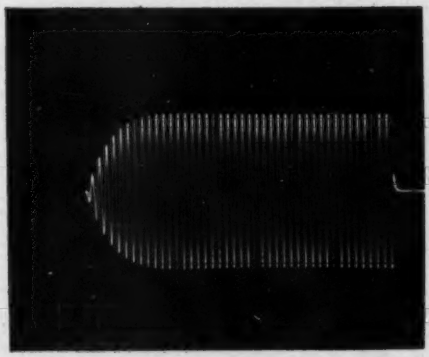


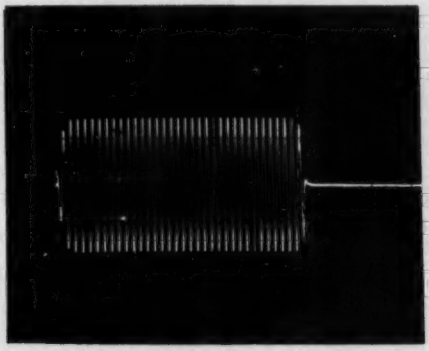
Fig. 5a. Schematic of the variable Q/frequency active filter.



Horiz – 20 ms/cm, BW=18 Hz



Horiz – 20 ms/cm, BW=56 Hz



Horiz – 20 ms/cm, BW=242 Hz

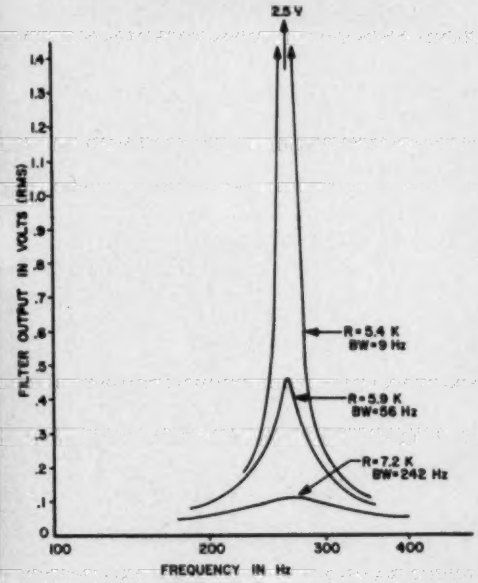


Fig. 5b. Responses of the variable Q/frequency filter at different bandwidths.

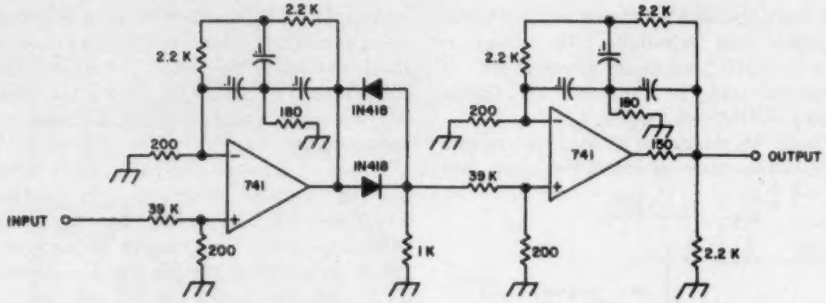
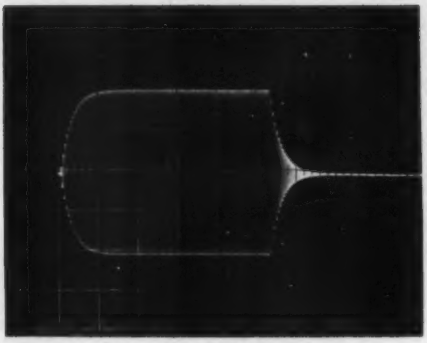


Fig. 6a. Schematic of the two stage active filter with a threshold detector between stages.



Horiz – 20 ms/cm, BW=16 Hz

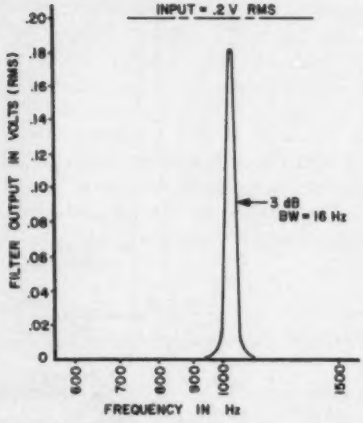


Fig. 6b. Response of filter with threshold detector.

forms are particularly sharp, considering the narrow bandwidths. The overshoot at a bandwidth of 56 Hz should not be objectionable. The gain of this filter is strongly dependent upon the Q setting, requiring the operator to adjust gain, unless the filter is followed by an audio stage with automatic gain control.

The data shown in Fig. 6b is for a two stage active filter with a diode threshold detector between stages.[5] The diodes prevent low signals (such as QRN) from passing through until the CW signal of the desired frequency is present, which provides quiet tuning between signals. The bandwidth of this filter is sharp (16 Hz) and the keyed wave form is good for this extreme bandwidth. Signals through this filter do ring somewhat and an interchange of capacitors to obtain a slight mismatch and broaden the bandwidth would help. The gain of this filter is near unity, and the frequency and Q are fixed.

I hope this discussion will help in the selection of the most suitable filter for your application.

...W6AGX

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1. McCoy, L.G., "The Selectoroid, A Simple High Performance Audio Filter," *QST*, Dec. 1966.

2. *The Radio Amateur's Handbook*, 1971 edition, "An Active Filter," pp. 131–132.

3. Russell, H.T., "Single Amplifier Active Filters Give Stable Q," *EDN/EEE* Jan. 1, 1972.

4. Artusy, M., "Tuneable Active Filter Has Controllable High Q," *Electronics*, Jan. 31, 1972.

5. Andes, C.B., "Threshold Detectors In A CW Audio Filter," *QST*, Dec. 1971.

George F. Ledoux K1TKJ/WA2SUR
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Application No. 871,122 Subject: ...

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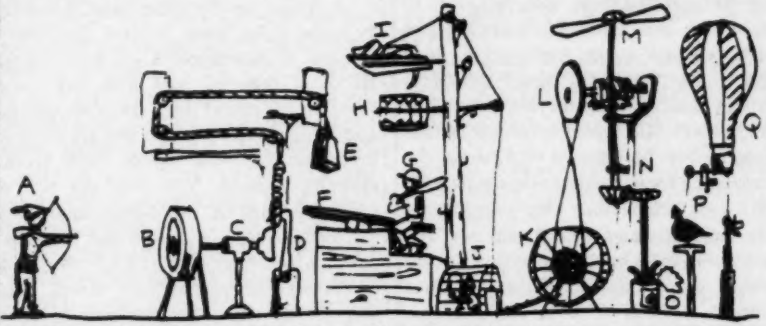
Concerning: A System To Achieve 85 dB Gain On A 2M Antenna



Archer (A) shoots arrow into bullseye of target (B), pushing plunger (C) and releasing noose from latch (D). Weight (E) drops onto south end of see-saw (F), catapulting designated hitter (G) from the north end. Bean-proof hard hat hits bottom of bass drum (H), waking sleeping dachshund (I) who jumps up raising door on cage (J) containing overweight squirrel Squirrel, following the veterinary's orders, jogs eagerly up the ramp into exercise wheel (K), turning pulley and gears (L). This rotates cooling fan (M) — a valuable side effect in summer months but annoying in the winter — and turns worm gear (N), stirring up a whole can of worms (O). Partridge (P) lunges at rising worms, pulling pin and releasing hot air balloon (Q), which raises antenna gain to a cool 85 dB (see M)

Fantastic Breakthrough!

The following article describes how to make a mobile two meter antenna with a measured gain of 85 dB! Yes, that's right, eighty-five dB gain.

This antenna results from my need for a high gain mobile antenna to go with a not too sensitive mobile rig. After much experimentation, machine shop work, and exhaustive lab testing, the following antenna emerged.

Construction should take only one evening and the parts should not be difficult to get. The instructions should be followed closely if optimum results are to be achieved.

The base of the antenna is an SO-239 connector. To this, four 50.80 cm copper radials are soldered into the holes provided in the SO-239. Care should be taken to see that a good ground connection is made to the body of the connector. Now the main radiator can be fabricated out of the same material (#10 wire does nicely), the length of the radiator being 46.99 cm. The element

should be soldered securely to the center pin of the SO-239 and be perpendicular to the radials.

SWR measurements can be made and the SWR adjusted by changing the angle of the radials to the body of the SO-239 and trimming the main radiator if necessary. The antenna was fabricated and taped to a wooden stick attached to my car in order to make the following gain measurements.

The output of my Hewlett Packard model 608A signal generator was connected to an antenna and a signal level set into the mobile receiver. The gain antenna was connected to the mobile at this time. The gain antenna was removed and a lab quality 50Ω load installed in its place. The signal generator output was raised to achieve the same signal level as before. The signal level out of the generator had to be raised 85 dB to get the same reference level in the mobile now with the 50Ω load connected. This proved that the gain antenna has a 85 dB gain over the 50Ω load. What? You thought that it was gain over a dipole, or was it over a quarter wave whip, or was it over an isotropic radiator, or was it over . . . ?

All too often this is the case. Gain figures are bandied about without telling what they refer to. Think of the term "dB gain" as meaning "more gain THAN." More gain than what? Do they tell you? Is this "system gain?" Is this power gain or voltage gain? These questions should be asked when you are told "This antenna has – – dB gain."

Dr. John D. Kraus in his Book, "Antennas," *McGraw Hill,* 1950, says, "Gain is always measured with respect to some reference antenna. Since an isotropic source is a hypothetical standard, it is common practice to make actual gain measurement with respect to a 1/2 wave reference antenna."

Unfortunately this is not always the case, especially in the ham antenna field. Some manufacturers rate their antennas over an isotropic source, while others rate them over a ground plane and others may even rate theirs over a 50Ω load! There is no agreed upon standard.

Let's look at the various standards and compare them to one another.

An isotropic source is often used as it gives the highest gain figures, i.e., a 1/2 wave dipole has a 2.15 dB gain over an isotropic source (this is not the reason that *all* manufacturers use isotropic source as a standard, but the reason that *some* do). For all practical purposes, let's say that an isotropic source has the lowest gain figures, highest numbers, of any antenna standard that radiates efficiently. An isotropic source exists only in theory. It is a point source, infinitely small, that radiates equally well in all directions of all planes. Think of the sun as an isotropic source radiating light in all directions throughout space.

A dipole, on the other hand, has directivity – therefore gain. If you put the same amount of power into a 1/2 wave dipole and all of it radiates, and you put the same amount of power into an isotropic source and all of it radiates, you will get more signal broadside off the dipole than from the isotropic source. You will get less signal from the ends of the dipole than from the isotropic source. A dipole has 2.15 dB gain over an isotropic source. 2.15 dB is equal to increasing the power 1.64 times. Another way to say this is an isotropic source with 164W will be equally as strong as a 1/2 wave dipole with 100W in the dipole's best direction. Of course, the same dipole will be much weaker than the isotropic source off the ends of the dipole.

A quarter wave whip is sometimes used as a standard. There is no exact measurement of the gain of a quarter wave whip. It depends on the size of the ground plane and the height above ground. The Electronic Industries Association Subcommittee has agreed that a quarter wave whip mounted on a ground plane 137 cm square and 152 cm off the ground, operated in the 150 MHz band has +1½ dB gain over a 1/2 wave dipole. Related to an isotropic source this is +.65 dB gain.

Some manufacturers, in order to play the numbers game, speak of voltage gain at the receiver. A receiver connected to a 1/2 wave dipole will have a voltage gain of 4.3 dB over one connected to the imaginary isotropic source (2.15 dB X 2 = 4.3 dB voltage gain). Voltage gain as expressed in dB is twice that of power gain in dB. For example, to double the power is to increase it 3 dB. To double the voltage is to increase it 6 dB. To increase

the power ten times is 10 dB. To increase the voltage ten times is 20 dB. Voltage gain can be used if a manufacturer wants to show large "dB numbers."

Another popular numbers game is to talk of "system gain." Add the dB gain of the two antennas together, one on each end of the circuit, and a dipole now has a system power gain of 4.3 dB over an isotropic source. It has 8.6 dB gain if we start talking of system voltage gain. Remember that this 8.6 dB gain is the gain of a *dipole*! Just think of the numbers that we could come up with for, say, a yagi.

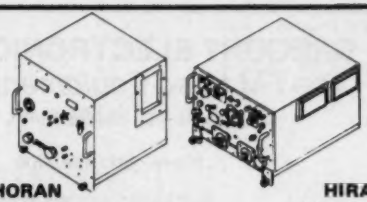
One popular 5/8 wave antenna on the market claims 3.7 dB gain (3.65 dB rounded off) over an isotropic source. This comes to 1.5 dB over a 1/2 wave dipole, and you will only realize that if you mount the antenna 1/2 wave above a ground plane. The 1/2 wave support pipe acts as part of the antenna to give that additional 1.5 dB gain. If you don't mount it on a meter-long pipe on your car (and who does) it's only a 1/2 wave dipole with 0 dB gain over a 1/2 wave dipole. This acts much like the coaxial antenna where the whip portion is one half of the antenna and the 1/4 wavelength sleeve is the other half. A coaxial antenna has a gain approaching that of the 1/2 wave dipole it electrically resembles.

These large differences in gain measurement are one of the reasons the FCC has required amateurs under the new repeater rules to know what gain their antennas actually produce.

As a rule of thumb, a given antenna will give equal gain as an antenna of similar size if both are of good design. Don't be misled by SWR as a measure of antenna efficiency. Remember that a 50Ω load loads well and has an excellent SWR, but does not radiate well. The gain of an antenna is directly related to its size. You will not get 16 dB gain from a four foot vertical two meter antenna unless its gain is related to a piece of wet string. Beware of small antennas that have big gain figures.

So the next time one of your friends, or even an enemy, tells you that his Super Wave Grabber has 14 dB gain, ask him, "14 dB over what?"

...K1TKJ



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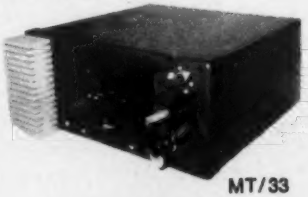

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COMPROMISE MULTIBAND ANTENNAS

Ideas on antennas to use for the "impossible QTH"

Many amateurs, even when living in private houses, encounter very difficult antenna installation situations. For instance, supposing one has available only a single elevated point to which an antenna can be attached, one desires multiband operation, there is no direct ground connection available at this point and one desires a reasonably small and inexpensive antenna structure.

It is assumed that one has tried a random length wire or other antenna form near the ground and found it unsatisfactory for reasons of performance or because of TVI or BCI problems. There have been many antenna forms developed to satisfy the above difficult installation conditions and their designs have ranged all the way from high quality trap or loaded designs (correspondingly expensive) to fanciful "magic" designs where full details of construction are not made public.

This article does not describe any "magic" type of antenna but rather tries to go through a brief analysis of the various antennas that one might consider for use under the conditions stated and which can be simply home built and provide reasonable performance. The form of antenna finally arrived at is a triangular loop with some special matching baluns. However, that is getting somewhat ahead of the story and one should first become acquainted with some of the considerations involved with other antenna forms under the installation conditions that are postulated.

Remembering the installation conditions and assuming that trap or loaded designs are not considered because of their constructional difficulty, tuning requirements, etc., the first antenna form one might consider is a short dipole.

Short Dipole

By a short dipole is meant one that is less than a ½λ long. For instance one might have a ½λ long dipole on 10 or 15 meters and then consider operating it on the lower frequency bands where it becomes a ¼ or even 1/8λ long dipole. Naturally, the feed point impedance of the dipole on the lower bands will no longer match the coaxial feedline to the dipole and a definite swr will exist on the line. Perhaps one question that

should be explored immediately, since some compromises are going to be necessary in the antenna design used, is the effect of swr on the line and how much swr can be tolerated. If the antenna/feedline system is a balanced one where a balun is used to go from a balanced antenna form to an unbalanced coaxial transmission line, the line is run for a reasonable distance at right angles to the antenna plane, etc.; the power reflected back from the antenna which it won't accept because of the feedline/antenna impedance mismatch will be dissipated mainly as a heat loss. This heat loss will occur in the line and in the matching network used between the transmitter and the line. Only a small amount of loss will occur because of radiation from the line.

So swr on the line need not necessarily be a cause for worry regarding TVI and BCI generated by excessive line radiation. The main compromise that one has to accept is regarding how much transmitter output power it can be tolerated to have lost via heat loss. The exact loss accumulated with any given type of transmission line and under any given swr condition can be found in antenna manuals. Figure 1 gives a brief summary of the losses that can occur under some typical conditions. For instance, if one used 30m of RG 58/U cable and the line had a 10:1 swr, the total loss would be 6.5 dB. In other words, slightly less than 25% of the transmitter power would be accepted by the antenna for radiation. If RG 8 were used, the total loss would be 2.8 dB or slightly over half the transmitter output power would be accepted by the antenna. The advantage of larger, low loss cable, if one can afford it, is apparent when dealing with a line having a high swr. For instance, if a 30m RG8/U line has a 5:1 swr, its total loss is only 1.7 dB which means that about 2/3 of the transmitter output power still reaches the antenna. This loss may be quite acceptable if it means that one can operate on several bands with a compromise antenna.

Loss for 30m of cable at 20 MHz		Additional loss for 10:1 swr	Additional loss for 5:1 swr
RG 58/U	2.5 dB	4	2
RG 59/U	1.5	3	1.5
RG 8/U	0.8	2	0.9

Fig. 1. Transmission line losses alone and additional loss for swr's of 10:1 and 5:1.

To return to the short dipole, one can find the input impedance of such an antenna described in great detail for various lengths of dipoles in many engineering texts. When the dipole is a ½λ long, its impedance is between 50 and 70Ω, depending upon height above ground and the size of the tubing used (a dipole constructed of tubing and supported in the middle is assumed). When the same dipole is used on a lower frequency band, where its total length becomes ¼λ, the input impedance rises to about 800Ω. Used on a still lower band, where the total length is 1/8λ, the impedance becomes about 1300Ω. These input impedances are also highly reactive. Obviously the direct connection of a coaxial line to such an antenna would produce excessive swr's if the antenna were operated on some band where its total length was less than ½λ. One idea that might be explored is the use of a reverse type of 1.4 balun. That is, step down the impedance by a factor of 4 on each band including the band on which the dipole is ½λ long. Theoretically, this should produce an swr of from 4 to 5:1 on each band, but in practice it is doubtful if any balun will function properly with the highly reactive impedance present. Also, the performance on the band where the dipole is ½λ long is compromised. The short dipole, as such, constructed from tubing, would appear to be a poor solution to the compromise antenna problem. The only exception would be if the dipole could be constructed sufficiently large from sheet metal or tubing to form a broad-band bow-tie type dipole. However, this would require considerable mechanical effort.

Short Vertical Antenna

The short vertical antenna deserves brief mention because it has frequently been accepted as a compromise multi-band antenna for military applications. But usually a good ground system has been available, and under such a condition the use of such an antenna is feasible. A good example is shipboard usage with steel-hulled vessels. Some amateurs may have come across sur-

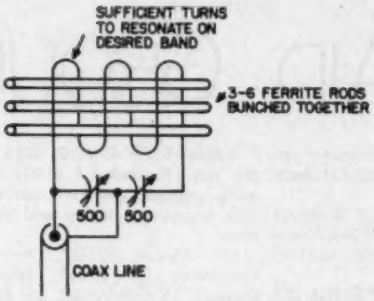

Fig. 2. Ferrite loop antenna for single band operation.

plus AN/BRA-6 tuners which belonged to a standby HF antenna system. A vertical antenna (unloaded) of some 5–7m in length was connected directly to a coaxial cable, when possible of up to RG 17/U size, and the tuner used at the end of the coaxial cable run next to the shipboard transmitter. Such a system was feasible since if one looks at the base impedance of a vertical antenna it will be found to vary from about 30Ω when the antenna is ¼λ at the operating frequency, to 10Ω when the antenna is 3/8λ long, to somewhat less than 5Ω when the antenna was 1/16λ long. So, even as a short vertical, the antenna did not produce swr's of much more than 10:1 on the transmission line. The overall result was that with an inherently low-loss transmission line, a good portion of the transmitter power was accepted by the vertical radiator which in itself, since no base tuning or loading was involved, could be temporarily clamped to any elevated portion of the ship's structure.

If one does indeed have a very good ground system that is large enough to be effective (¼λ or longer) even on the lower frequency bands, a remotely tuned, non-base loaded vertical is a good compromise antenna to consider. A tin sheeted roof, for instance, might provide such a ground. However, if one does not have an adequate ground, the vertical with short radials will not work any better than a short dipole. The only type of vertical that might be satisfactory without a ground system is one ½λ long. Such an antenna is not physically feasible normally on the lower frequency bands.

Loop Antennas

A loop antenna is not normally thought of being much of a transmitting antenna, except in its larger forms when it is the size of a Quad element. Some designs using small loops for the frequency of operation involved have been developed for military purposes where a high angle of radiation was desired and the loop used as a field antenna located close to the ground. In this case, the loop was resonated for each particular operating frequency using a tuning network located at the base of the loop. Some twenty odd years ago some amateurs experimented with extremely small loops (on the order of 60 cm diameter) for apartment type usage as transmitting antenna. Such experimentation continues even today. Several European amateur magazines have described ferrite stick loop antennas, such as shown in Fig. 2, for use as transmitting loops for difficult antenna locations. Such loops are tuned for operation on one band only, although of course they can be bandswitched once the constants for each band have been found by experimentation. The capacitor divider network shown on the loop in Fig. 2 is used to resonate the loop on the operating frequency for maximum output while at the same time using the variable capacitance divider to match the impedance of the coaxial feedline for a 1:1 swr.

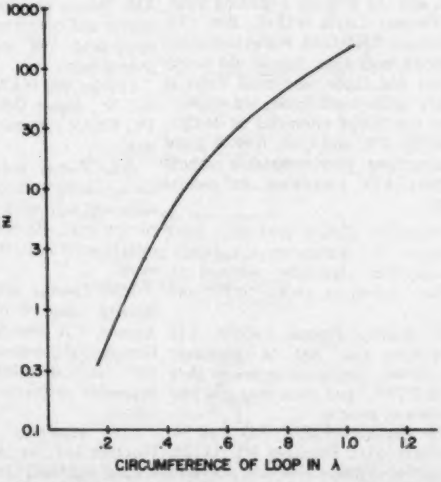

Fig. 3. Radiation resistance of a loop as a function of its size.

TECHNICAL AID GROUP

The Technical Aid Group is a group of hams who have indicated a willingness to share their knowledge and skills with others. They have volunteered to be of service to fellow hams and do so without compensation. If you have a technical question, look over the list to see who has competency in the area of your question. For many of the TAG members, descriptions of all areas of expertise would be lengthy, so an abbreviated description is given. When stating your problem, give as much information as possible and clearly state the difficulty. Enclose a SASE for reply.

For those hams who have a desire to share, the TAG is the thing for you. Send a brief note requesting the membership form, fill it in and send it back. It asks a few questions about your qualifications, and there is a check-list to indicate your fields of competence. These cover all modes currently used by hams, antenna design and theory, transmitter and receiver design for HF, VHF, and UHF, logic, ICs, general help, and other areas. As more members are added, their names and addresses will be published.

Robert Perlman WB2VRW, 3 Josten Place, Hudson NY 12534. Electrical engineering student. Will help with Novice transmitters and receivers, and any help for beginning hams.

Thomas Laffin W1FJE, Box 133, Hillsboro NH 03244. Radio communications technician. Special aid to ex-CBers and those who need terms in easily understood terms; aid to Novices and Techs interested in MARS, RACES, CD, and CAP; how to build and scrounge parts; assistance on ham history, ATV, microwave, and general help.

Theodore Cohen W4UMF, 8603 Conover Pl., Alexandria VA 22308. Geophysicist. Specially prepared to answer questions about SSTV and ATV.

J. Bradley Flippin K6HPR, 116 Montecito Ave., Apt. M., Monterey CA 93940. Electronic engineer. Help with RTTY, data processing and programming, general.

Ira Kavaler WA2ZIR, P.O. Box 54, Flatbush Sta., Brooklyn NY 11226. Electrical engineer. Assistance offered in theoretical aspects of electricity and electronics from dc to UHF, design of equipment, computer programming, and signal circuit (failsafe) design.

John Teich WB2JAE/6 Ruddock, Cal Tech, Pasadena CA 91109. Novice and rig problems, solid state and logic circuitry.

David Felt WB6ALF, P.O. Box 261, Sierra Madre CA 91024. Electronics engineer. Qualified help in logic, digital and analog design, solid state, AM and TV.

Robert Groh WA2CKY, 65 Roxborough Rd., Rochester NY 14619. Communications engineer. Bob can lend a hand in HF and VHF transmitter and receiver design as well as solid-state logic and digital techniques.

Carl Miller WA6ZHT, 334 Paragon Ave., Stockton CA 95207. Computer technician. Carl's specialty area is solid-state QRP.

George Daughters WB6AIG, 1560 Klamath Dr., Sunnyvale CA 94087. Research associate. HF transmitter and receiver, SSB, and solid state, are George's fields.

D. Hausman VE3BUE, 267 Northcrest Pl, Waterloo, Ontario, Canada. Student. Novice transmitter and receiver problems as well as logic, digital techniques and ICs.

Hugh Wells W6WTU, 1411 18th St., Manhattan Beach CA 90226. Electronics instructor. Hugh can help with AM, Novice problems, VHF-UHF receivers and converters, solid state, test equipment, FM and repeaters, and general help.

Charles Hill WA7LQO, 4005 Campbell St., Baker OR 97814. Student. TV, Novice transmitter problems, and logic.

John Perhay WAØDGW, Route 4, Owatonna MN 55060. EE technician. John will help with RTTY, AM, SSB, Novice gear, HF transmitters and receivers, solid state, ICs, and test equipment.

Ron Thomas W8QYR/6, 1928 S. Beverly Glen Blvd., Apt. 12, Los Angeles CA 90025, tel. 556-2721. Commercial communications experience. Ron is willing to assist with beginners' problems, theory and regulations.

Jim Jindrick WA9QYC, 801 Florence Ave., Racine WI 53402. Consulting engineer. General help as well as HF, VHF, and UHF antennas, transmitters, and receivers.

William Welsh W6DDB, 2814 Empire Ave., Burbank CA 91504. Electronic engineer. Beginner's problems, code instruction, theory and regulations.

Ken Knecht W2GYF, Box 39, Clintondale NY 12515. Televsion engineer. TV video, logic, and digital techniques.

Tom O'Hara W6ORG, 10253 E. Nadine St., Temple City CA 91780. Communications engineer. RTTY, TV, AM, SSB, VHF antennas, transmitters and receivers for HF through UHF, solid state, and general help.

Bruce Creighton WA5JVL, 2517 Metairie Ct., Metairie LA 70002. Electrical engineer. Antennas, Novice problems, solid state, logic, digital techniques, test equipment, and general help.

Tom Borok WB2PFY 215-33 23 Rd., Bayside NY 11360. Student. Tom is especially qualified to help Novices with their problems with transmitters and receivers, HF and VHF antennas, HF receivers, test equipment, and surplus, Morse code instruction.

Roger Taylor K9ALD, 2811 William St., Champaign IL 61820. Engineer. Roger is adept with AM, SSB, antennas, solid state, logic and digital techniques, ICs, test equipment, and other general help.

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John Allen K1FWF, 112 Edgemoor Lane, Ithaca NY 14850. Technical director. John's areas of assistance are VHF and UHF antennas, receivers, and transmitters, solid state and digital techniques. ICs, and SSB.

Eugene Fleming WØHMK, 1327 Prairie Rd., Colorado Springs CO 80909. Radio and television repair experience. Eugene will be glad to help with HF transmitters, receivers and test equipment. In addition to letters, he will accept open reel tape and braille correspondence.

Roger A. Baim WB9BDP, 2753 W. Coyle, Chicago IL 60645. Electrical engineer. Roger conducts Novice and General Class code and theory courses and will be happy to assist those seeking licenses.

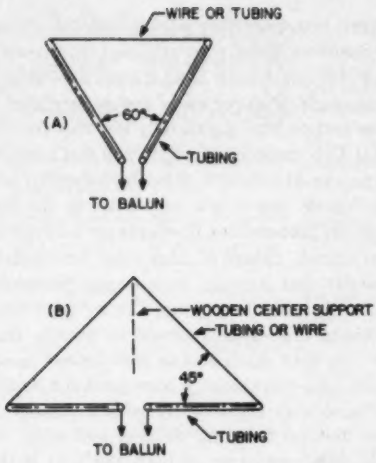

Fig. 4. The forms of triangular loops which lend themselves to single point support at the base.

Such miniature loops work to a degree but no one will deny that they are extremely inefficient. If, however, one starts to investigate the loop possibilities somewhere between those of the quad size loop and a miniature loop, some interesting results occur. For instance, Fig. 3 is a plot of the impedance of a loop as a function of its circumference in wavelengths. The impedance for a loop less than a wavelength in circumference is approximately equal to:

$$197 \times (\text{Circumference in } \lambda)^4$$

The impedance falls off very rapidly as the size of the loop becomes small in terms of wavelengths. But, nonetheless, the values themselves do remain within manageable limits if the loop is not made extremely small.

There are many designs that one can develop from the loop antenna idea if one studies the chart and some of the impedance matching transformers described later. For instance, a "loop" using the forms of Fig. 4(A) or (B) and having a total circumference of from 9 to 12m are quite feasible using a combination of aluminum tubing and heavy wire construction. Such a loop on 15 meters will have a circumference of about a .75 wavelength and hence an impedance of about 40Ω. On 20 meters it is about .5λ with an impedance of 12Ω. On 40 meters the circumference is .25λ with an impedance of about 1–2Ω.

Feeding such a loop with a coaxial line directly (but through a balun for symmetry) would not produce an intolerable swr on 15 or 20 meters but there would hardly be too much hope of any performance on 40 meters. Since a balun has to be used anyway, it would be better to raise the impedance of the loop by a fixed factor to provide a somewhat better match on 40 meters. For instance, if all impedance levels were raised by a factor of four, the 15 meter impedance would be 160Ω, the 20 meter impedance 48Ω and the 40 meter impedance 4–8Ω. The 15 meter swr still remains tolerable, the 20 meter matching has been considerably improved, and at least there is a better chance of getting some power into the antenna on 40 meters.

The method to accomplish these impedance changes is a little bit different than the usual 4:1 balun which goes from say 50Ω unbalanced to 200Ω balanced. Here we would like to raise the balanced (antenna) impedance while going from a balanced to unbalanced condition. This can be done by using either one or two standard toroid balun kits but wound as shown in Fig. 5. What is done is that the balanced load (antenna) is first transformed to an unbalanced load by one toroid winding. Then a 4 times unbalanced to unbalanced step-up

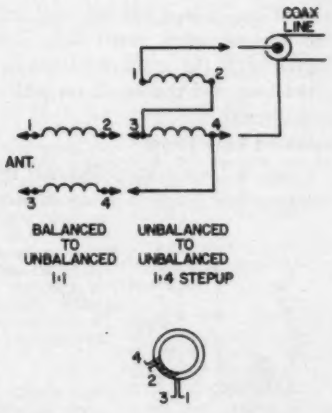

Fig. 5. Two baluns are required. Each can be wound on half of a toroid or on two separate toroids.

toroid winding is used to go into the coaxial line. The two windings may be placed on one toroid core by having each winding occupy half of the core or separate cores may be used.

The low base impedance of this type of antenna allows construction to be simplified since the base insulator need not be a good RF insulating material. For instance, if the antenna form of Fig. 4(A) is constructed by having each of the V arms being a length of TV mast or other tubing, the base plate where they come together can be a hard wooden board to which they are bolted.

Theoretically the efficiency of such a loop antenna, except for the line losses, can be quite high since it is dependent on the ratio of the ohmic losses of the antenna structure to the impedance on each band.

If the antenna structure is constructed carefully such that the ohmic loss is a small fraction of an ohm, one can even expect that on 40 meters most of the power accepted by the antenna will be radiated. In practice, of course, the theoretical efficiency is never achieved for a number of reasons. The baluns do not function exactly as desired with low impedance loads, the bonding between antenna sections will invariably introduce some ohmic loss, etc. Nonetheless, the antenna will radiate and definitely get some signal coupled into space from hopefully an elevated position from which it can do some good.

As was mentioned before, one can determine various other small loop designs, depending upon the space available to construct the loop and the bands on which one wants to operate.

Transmission Line Tuner

A tuner is invariably required in the transmission line if one is going to accept a coaxial line operating with a high swr. Some transmitters will accept and load into coaxial lines directly which have a high swr. This is particularly true for some low-power Novice class designs but is generally not true for the usual SSB transceiver which will not tolerate a line swr of over 2:1. Usually, however, one also has to use a low pass filter in the line after the transmitter to eliminate TVI problems. Such filters if they are to operate properly and provide their design harmonic attention must be operated in a "flat" line.

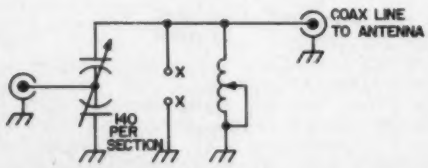

Fig. 6. Simple transmission line tuner to couple coax line operating at a high swr into a transmitter requiring 50–70Ω load at a low swr.

There are various forms of tuners that one can find described in the various handbooks and magazines. I have used the design of Fig. 6 very successfully with a number of experimental antenna designs and with coaxial lines operating at high swr's. It is the familiar "trans-match" design. Extra capacity has to be added across the terminals "XX" for use on 40 and 80 meters. The exact value depends on the impedance being matched and will vary from 100–500 pF. Another variable capacitor in series with the output is sometimes shown with this design coupler but I have rarely found it to be absolutely necessary if the coil tap point is carefully adjusted. The variable capacitor is set at maximum to start the tuning process and the coil tap point, using the minimum amount of inductance found which produces the minimum swr on an swr meter located between the transmitter and the tuner (the transmitter was initially tuned up using a dummy load). The variable capacitor is then tuned to further lower the swr and the process repeated until the lowest possible swr is obtained. As a final check, a field-strength meter should be used to check that the coil tap position used also provides the best field strengths.

Summary

Under the initital environmental and constructional restraints stated, a small loop appears to offer the best chance of achieving a degree of satisfactory multi-band operation until a more sophisticated multi-band antenna can be installed. The charts and example presented should allow one to arrive at a design which satisfies almost any immediate need.

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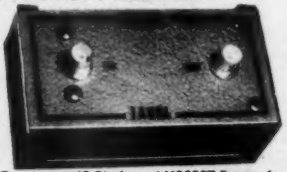

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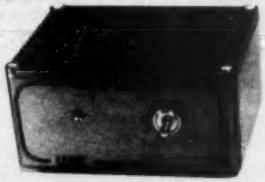

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SPINOFFS: FROM NASA TO THE RADIO AMATEUR

Probably better than anyone else, the radio amateur fully recognizes that one of the great sophistications of our space program has been radio communications. The many successes of our manned and unmanned capsules and satellites are old hat by now, but consistent success obviously would not have been possible without significant advances in telemetry, communications, and more specifically, electronics. Probably no industry in the world, at any time, has advanced the state of the art of electronics as has NASA, through its vast network of contractors and subcontractors.

Fortunately for general industry – and for the radio amateur – NASA and the Atomic Energy Commission have established a program to disseminate much of this information to the general public. NASA calls this program the "Technology Utilization Program." Its purpose is just what it says, to pass on to the public those developments which could have potential use outside the aerospace and nuclear communities. The object of all this is to allow NASA and the AEC to earn for the public an increased return on the public's investment in aerospace and nuclear research and development programs. The whole concept is often referred to as the "spinoffs" from space.

In the course of my work, I have been privileged to review many of the publications published for this purpose by NASA. While many of the offerings are highly specialized and mostly applicable to industry, we did note a few that are worth passing on to the radio fraternity.

What follows are selected extracts that appeared in recent NASA bulletins, more specifically, SP-5942(01) and SP-5943(01). The first bulletin is entitled, "DC Power Circuits" and the second, "Testing Methods and Techniques: Testing Electrical and Electronic Devices." Both bulletins are available through the National Technical Information Service, Springfield VA 22151, at $1.00 a copy. Each bulletin also includes a reader's service card for additional information.

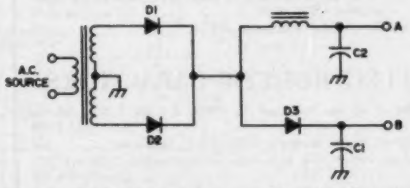

Fig. 1. Dual-voltage power supply with increased efficiency.

You will note in each case values of electronic components are omitted. This was not an oversight, as the bulletins do not as a rule show the value of the specific component to use. It's quite possible that sending in the reader's service card mentioned above will bring the reader this additional information. On the other hand, the more knowledgeable and enterprising amateur can substitute his own values and still get the

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desired results. The code following each project is a NASA code for reference purposes.

Dual-Voltage Power Supply

This circuit can be used in lieu of relatively complex and expensive voltage regulators to supply dual voltages wherever precise voltage regulation is not required.

Figure 1 shows the primary winding of the power transformer is connected to the ac source, and the secondary winding is connected to the full-wave rectifier consisting of diodes D1 and D2. The unfiltered output from the full wave rectifier is fed, in parallel, to a conventional choke-input filter branch and a diode-capacitor branch. The diode, D3, in this branch conducts on the peaks of the full-wave rectifier current and charges capacitor C1 to the peak voltage across one-half of the secondary winding of the power transformer. The voltage at terminal A is approximately 40% greater than at terminal B. The required peak inverse-voltage rating of diode D3 is only one-half the peak voltage across the full secondary winding. For maximum voltage output at terminal A, a high conductance semiconductor diode is used in the branch. Source: Lewis Research Center (LEW-90107).

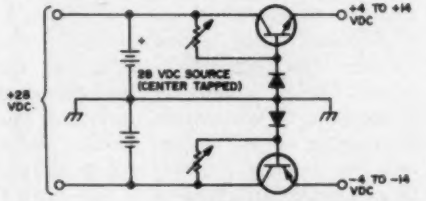

Fig. 2. Dual polarity power supply.

Dual Polarity Power Supply

A majority of electronic systems use individual oscillator-transformer-rectifier power supplies, operating from 28V dc to supply a positive and negative voltage for the subassembly units. In Fig. 2, the dual polarity power supply provides a +14 and -14V to operate the various subassembly electronic modules directly, instead of using a 28V dc supply with the negative terminal grounded. Other 28V accessories; i.e., motors, relays,

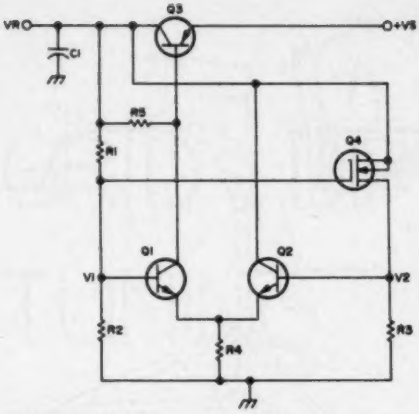

Fig. 3. MOSFET improves power supply regulator.

and solenoid valves can be operated on a 28V input, with the return to -14V. Using separate supplies provides a measure of redundancy and minimizes electronic interference from closing relays and switches.

The circuit performs the function of a power distribution network for the other modules, without the need of a transformer. Important advantages of the unit include significant reductions in weight, size and costs, and internal power dissipation.

Source: G.O. Bohot, P.E. Fincik, and A.L. Varneau of No. Am. Rockwell Corp. under contract to Manned Spacecraft Center (MSC-17072)

MOSFET Improves Performance of Power Supply Regulator

The circuit shown in Fig. 3 provides a higher degree of power supply voltage regulation and temperature compensation than a conventional circuit using a zener diode as a voltage reference. The improvement is made possible by using a MOSFET, Q4, as the voltage reference in place of the zener diode. As in the case of the conventional regulator, the improved regulator utilizes a bridge circuit R1, R2, Q4 (in place of a zener diode) and R3, and a difference amplifier consisting of Q1, Q2, and R4, and R5 allowing initial operation at power turn-on. The regulator performance is determined by the voltage difference between V1 and V2 produced by a change in regulator supply VR. The difference amplifier gain and current gain of transistor Q3 amplify this voltage difference to determine the closed loop performance. Cross coupling of the gate of Q4 to the base of Q1 allows Q4 to serve also as an additional amplifier.

Source: D.C. Lokerson, Goddard Space Flight Center (GSC-10022)

Testing Semiconductors Without Disconnecting Them From Circuit

An oscilloscope, together with the test circuit shown in Fig. 4, can be used to check semiconductors that are wired into a circuit. For transistors, approximate gain and linearity can be determined; for diodes, open

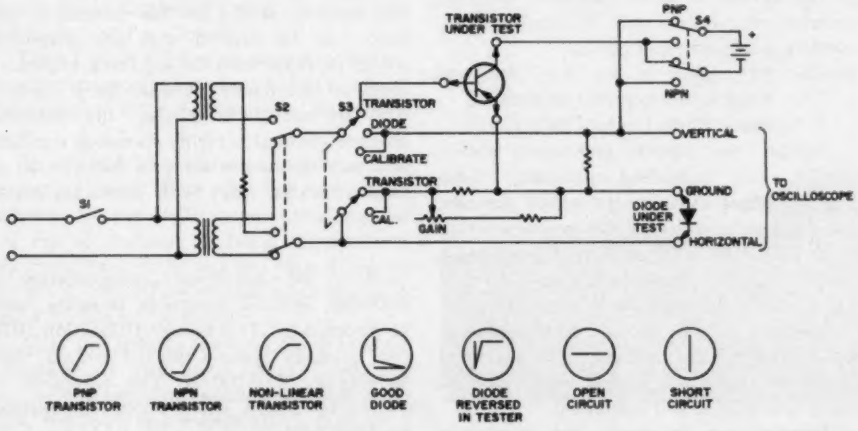

Fig. 4. Circuit for testing semiconductors "in circuit."

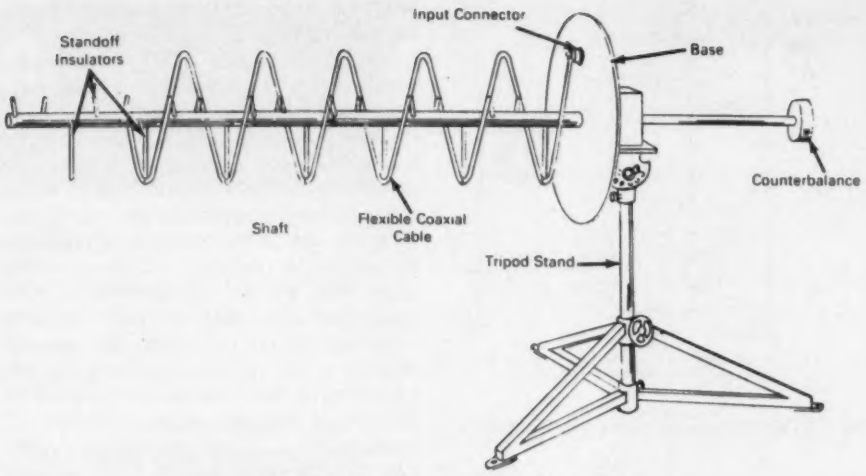

Fig. 5. Economical weatherproof helical antenna.

circuits, short circuits, and reversed polarity are indicated clearly. The quality and breakdown point of low voltage (less than 10V) zener diodes can be measured.

The idealized oscilloscope traces show the types of waveforms to be expected under various circumstances, provided that the impedance of the external circuit is much greater than that of the component under test. If this is not so, the waveforms will vary, depending on the external circuit properties. In either case, when an assembly to be tested contains multiple identical circuits, the tester may be employed to identify a defective component.

Source: B.C. Allen of No. Am. Rockwell Corp. under contract to Marshall Space Flight Center (MFS-1163)

Besides the reports mentioned above, NASA also published periodic "Tech Briefs," short data sheets which describe specific solutions to specific problems. One such Tech Brief – #70-10016 – describes a simple and economical helical antenna that has application to amateur radio:

The Problem: To provide an inexpensive, weatherproof, helical antenna which requires minimum maintenance and which can be easily transported and assembled.

The Solution: Previously, helical antenna elements have been formed from soft copper tubing, shaped with a customed-machined mandrel. Antennas made by this method are very expensive, and furthermore, are susceptible to corrosion. Both of these problems have been solved by using a semi-rigid coaxial cable to form the helical element.

How It's Done: The helix of the weatherproof antenna illustrated in Fig. 5 is made of foam dielectric, heliax transmission line that has been shorted out at each end. The helix is formed by mounting the transmission line on standoff insulators, which are attached to the antenna shaft. By this technique, the helix can be formed with any diameter, pitch, or taper without requiring expensive tools or techniques. Because the p conductors are sealed in plastic, the resulting antenna element is highly corrosion resistant and may be used at seacoast facilities or on range tracking ships with minimum maintenance.

Note: No additional documentation is available. Specific questions, however, may be directed to: Technology Utilization Officer, Kennedy Space Center, Florida 32899, Reference: B70-10016. This invention is owned by NASA and a patent application has been filed.

. . .WB2ICV

P. Fischer VE3GSP
1379 Forest Glade Road
Oakville, Ontario
Canada

GRID DIP TUNING THE QUAD

This article describes an effective procedure of tuning the radiators and parasitic elements of a quad antenna with the aid of a grid-dip meter. It is important to tune not just the radiators but also the reflector and director elements for optimum results.

Some time ago, I ordered my 3 band, 2 element spider type fiberglass quad. I assembled it according to instructions, fit the toroid balun to permit a single feedline and put it on top of my tower.

Then I asked a friend to supply me with a steady carrier signal on the 3 bands to adjust the reflector stubs for optimum front/back ratio.

On 15 and 10 meters I couldn't reach a maximum since there was not enough to shorten out, and on 20 meters I had to add a few cm of stubwire to reach a maximum. My front/back ratio was less than 2 S-units for the 15 and 10 meter band and between 3 and 4 S-units for 20 meters.

After this tedious tower climbing exercise I checked my SWR on all bands. It was 3:1 on the average. The feedline was shortened foot by foot and eventually I reached a glorious SWR of 2:1 on 20 and 15, and 2.8:1 on 10 meters.

Well, I wasn't pleased with it and there was a long way to go for the manufacturer's spec of 1.14:1 on all bands. I borrowed an antenna bridge (antenna-scope) to measure the antenna impedances at the various bands. The results were inconclusive; maybe the bridge didn't work well or the radiators were too far off resonance. After that I

The author contemplates the problem of getting his new quad to the top of his tower.

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decided to use a grid-dipper to check the resonance frequencies of all radiator and reflector elements.

Radiator Resonance Measurement

I connected a 5 turn "pick-up" coil to the end of the coax feedline down in my shack and dipped the resonance frequencies of the 3 bands carefully. The dips were weak but readable. Before measuring each band I calibrated the grid-dipper on my receiver. Only the 20 meter radiator resonated within the amateur band, while the 15 and 10 meter radiators were 500 and 900 kHz below the band edges.

To measure the reflectors I climbed up the tower and tried to dip the reflectors by coupling the grid-dipper to the reflector loops. Unfortunately I couldn't get a dip at all. Upon this I took my quad down and stuck it on a 3 meter pipe in my back yard. Down there I measured the radiator resonances to know the ground effects on the resonance frequencies. The resonance frequencies were about 100 kHz lower than up in the air.

All radiator wires were readjusted to give resonance readings at 14.05, 21.05 and 28.5 MHz (this measurement was done with the feed line connected). Up in the air this should give me my desired centerband frequencies of 14.15, 21.15 and 28.6 MHz.

Reflector Resonance Measurement

My next problem was to measure and optimize my reflector elements. To do this I replaced all tuning stubs with 10 turn, 1 cm diameter wide spaced silverware coils. These coils were supported on the original nylon stub spacers. See Fig. 1. The reflectors could now be dipped easily by coupling the grid-dipper to the end of the stub-coils.

While my 20 meter reflector resonated 350 kHz below the according radiator element, the 15 and 10 meter reflectors resonated too low by 900 kHz and 1.8 MHz respectively. Since the 20 meter band per-

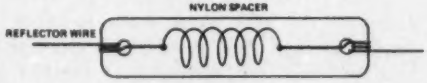

Fig. 1.

formed best before I readjusted the other reflector loops to give resonance frequencies of 400 kHz (15 meters) and 500 kHz (10 meters) below the related radiator resonance frequencies.

I checked and rechecked all resonance frequencies and raised the antenna gain. Then I redipped all elements "up there." This is easy with a 2 element quad since each element can be reached from the tower. Only the 15 meter reflector required some adjustment. I shortened 5 of the 10 turns of the "stub coil" to increase the resonance frequency by 150 kHz.

Results

Now I measured the SWR again. It had decreased to: 1.25:1 (20); 1.15:1 (15); 1.3:1 (10); centerband readings, and, at the lower band edges: 1.5:1 (20); 1.4:1 (15); 1.6:1 (10). The front/back signal ratio improved also: I measured 3–4 S-units on 20 meters, 4 S-units on 15 and 10 meters. At the side of the antenna I measured signal rejections as high as 10 S-units (60 dB).

The tuning procedure for a quad antenna with a grid-dipper is very effective and gives superior results. All antenna elements are tuned individually; this definitely beats my trial and error technique. Three and four element quads can be tuned the same way. As a matter of fact, grid-dipping is the only way to tune the director elements, since neither the F/B ratio nor the directivity pattern can be measured sufficiently accurately to permit precise conclusions.

The resulting performance and low SWR are certainly worth the effort.

The table below gives suggested resonance frequencies for the various bands and elements of a quad. Two sets of values are given. The values in parentheses give your quad a wider bandwidth and slightly lower SWR over the entire band. In return the front/back signal ratio and antenna directivity decrease somewhat.

	Center frequency		
Reflector	13.85(13.6)	20.8(20.5)	28.1(27.7)
Radiator	14.2(14.2)	21.2(21.2)	28.6(28.6)
Director 1	14.6(14.9)	21.7(22.0)	29.2(29.6)
Director 2	15.1(15.7)	22.3(22.9)	29.9(30.7)

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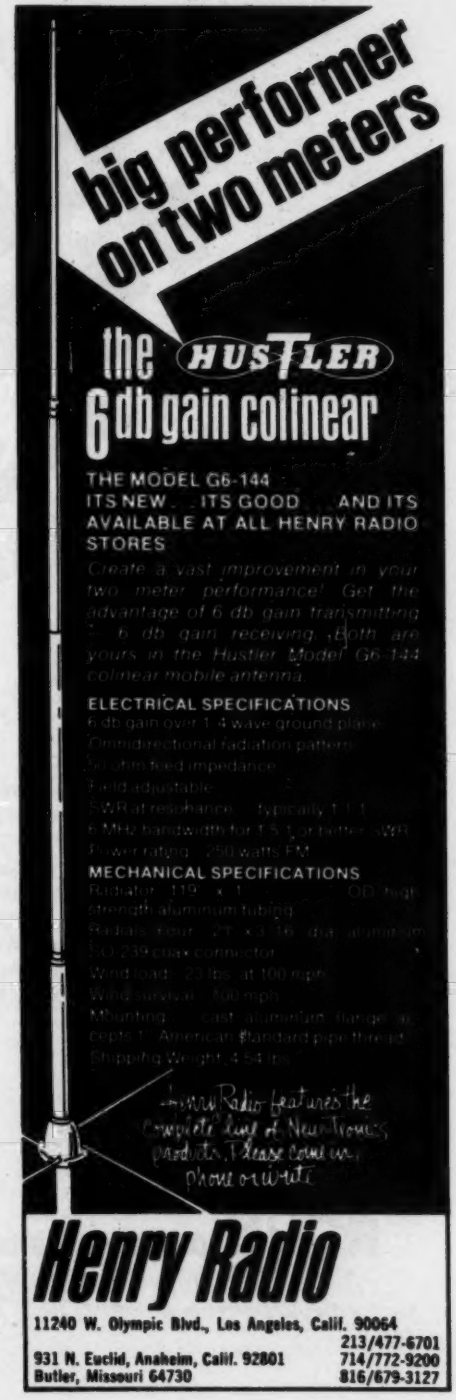
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FCC RULES AND REGULATIONS, PART 97 (II)

Continuing from last month the complete text of the FCC Rules & Regulations pertaining to the Amateur Radio Service.

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97.33 Eligibility for re-examination.
97.35 Additional examination for holders of operator licenses obtained by mail.

STATION LICENSES

97.37 General eligibility for station license.
97.39 Eligibility of corporations or organizations to hold station license.

§ 97.29 Manner of conducting examinations.

(a) Except as provided by § 97.28, the examination for Amateur Extra, Advanced and General Classes of amateur operator licenses will be conducted by an authorized Commission employee or representative at locations and at times specified by the Commission.

(b) Unless otherwise prescribed by the Commission, an examination for the Conditional, Technician, or Novice Class license will be conducted and supervised by a volunteer examiner selected by the applicant. A volunteer examiner shall be at least 21 years of age and shall be the holder of an Extra, Advanced, or General Class Amateur Radio operator license, or shall hold a Commercial radiotelegraph operator license issued by the Commission, or shall be employed in the service of the United States as the operator of a manually operated radiotelegraph station. The written portion of the examination shall be obtained, supervised, and submitted in accordance with the following procedure:

(1) Within 10 days after passing the required code test, an applicant shall submit an application (FCC Form 610), together with any filing fee prescribed, to the Commission's office at Gettysburg, Pennsylvania, 17325. The application shall include a written request from the volunteer examiner for the appropriate examination papers. The examiner's written request shall include (i) the names and permanent addresses of the examiner and the applicant, (ii) a description of the examiner's qualifications to administer the examination, (iii) the examiner's statement that the applicant has passed the code test for the class of license involved under his supervision within the 10 days prior to submission of the request, and (iv) the examiner's written signature. Examination papers will be forwarded only to the volunteer examiner.

Note: When the applicant is entitled to examination credit for the code test under one of the provisions of § 97.25, an application may be submitted without regard to the 10-day limitation. The examiner's request should then state that a code test was not administered for that reason. The applicant should furnish details as to the class, number, and expiration date of any Commercial radiotelegraph license involved.

(2) The volunteer examiner shall be responsible for the proper conduct and necessary supervision of the examination. Administration of the examination shall be in accordance with the instructions included with the examination papers and as prescribed in §§ 97.29 (c) and (d), 97.31, and 97.33.

(3) The examination papers, either completed or unopened in the event the examination is not taken, shall be returned by the volunteer examiner to the Commission's office at Gettysburg, Pa., no later than 30 days after the date the papers are mailed by the Commission (the date of mailing is normally stamped by the Commission on the outside of the examination envelope).

(c) The code test required of an applicant for amateur radio operator license, in accordance with the provisions of §§ 97.21 and 97.23 shall determine the applicant's ability to transmit by hand key (straight key or, if supplied by the applicant, any other type of hand operated key such as a semi-automatic or electronic key) and to receive by ear, in plain language, messages in the International Morse Code at not less than the prescribed speed, free from omission or other error for a continuous period of at least 1 minute during a test period of 5 minutes counting five characters to the word, each numeral or punctuation mark counting as two characters.

(d) All written portions of the examinations for amateur operator privileges shall be completed by the applicant in legible handwriting or hand printing, and diagrams shall be drawn by hand, by means of either pen and ink or pencil. Whenever the applicant's signature is required, his normal signature shall be used. Applicants unable to comply with these requirements, because of physical disability, may dictate their answers to the examination questions and the receiving code test and if unable to draw required diagrams, may dictate a detailed description essentially equivalent. If the examination or any part thereof is dictated, the examiner shall certify the nature of the applicant's disability and the name and address of the person(s) taking and transcribing the applicant's dictation.

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2. 73 will have a lot more new readers - amateurs who will hopefully become psychologically dependent upon the magazine and renew at the end of the gift year at the regular subscription rate - thereby eventually making this deal worthwhile for 73.

3. You will have a way to get rid of all those crystals that have been kicking around after repeaters have changed channels, or you have moved from one repeater area to another.

4. 73 will build up a crystal bank for whatever devilish purposes they may have in mind - whether it be rental of crystals for amateurs on trips - or perhaps even the outright sale of them. They might even cook up some sort of subscription premium arrangement. You never know.

WHAT YOU SEND:

1. The name and address, including call letters and zip, of the friend to be endowed with the gift subscription to 73. If you send this in by June 30th, they should start their subscription with the August issue. This offer is valid for new subscriptions only, not for renewals or extensions. For $2 we can't stop and look them up in the computer to see if they are already in there.

2. Send $2 in cash, check, money order, IRC's, or anything negotiable for each gift subscription.

3. Tape each crystal to a 3 x 5 card and mark on the card this data: make of set the crystal was made for - transmit or receive frequency - your name, address, and call on the card in case the crystal is a bummer, in which case we'll need another one, or $4 to buy a new one to replace it in the crystal bank. Crystals for the following transceivers are acceptable: Clegg, Drake, Genave, Gladding, Inoue(Icom), Grove, Pearce-Simpson, Ross and White, SBE, Simpson, Sonar, Standard, Swan, Telecomm, Tempo, Varitronics, Yaesu. Use enough tape to hold the crystal to the card, but please do not overdo it!

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§ 97.31 Grading of examinations.

(a) Code tests for sending and receiving are graded separately. Failure to pass the required code test for either sending or receiving will terminate the examination.

(b) Seventy-four percent (74%) is the passing grade for written examinations. For the purpose of grading, each element required in qualifying for a particular license will be considered as a separate examination. All written examinations will be graded only by Commission personnel.

§ 97.33 Eligibility for re-examination.

An applicant who fails examination for an amateur operator license may not take another examination for the same or a higher class amateur operator license within 30 days, except that this limitation shall not apply to an examination for an Advanced or General Class license following an examination conducted by a volunteer examiner for a Novice, Technician, or Conditional Class license.

§ 97.35 Additional examination for holders of operator licenses obtained by mail.

(a) A licensee who holds an amateur license which was obtained by a mail examination under the supervision of a volunteer examiner may be required to appear for a Commission supervised license examination at a location designated by the Commission. If the licensee fails to appear for this examination when directed to do so, or fails to pass such examination, the operator license involved shall be subject to cancellation. When a Novice, Technician, or Conditional Class license is cancelled under this provision, a new license will not be issued for the same class operator license as that cancelled.

(b) [Reserved]

(c) A holder of a Conditional Class license, obtained on the basis of an examination under the provisions of § 97.29(b), is not required to be re-examined when changing residence and station location to within a regular examination area, nor when a new examination location is established within 175 miles airline distance from such licensee's residence and station location.

Station Licenses

§ 97.37 General eligibility for station license.

An amateur radio station license will be issued only to a licensed amateur radio operator, except that a military recreation station license may also be issued to an individual not licensed as an amateur radio operator (other than an alien or a representative of an alien or of a foreign government), who is in charge of a proposed military recreation station not operated by the U.S. Government but which is to be located in approved public quarters.

[*§ 97.37 revised eff. 10-17-72; VI(72)-1*]

§ 97.39 Eligibility of corporations or organizations to hold station license.

An amateur station license will not be issued to a school, company, corporation, association, or other organization, except that in the case of a bona fide amateur radio organization or society, a station license may be issued to a licensed amateur operator, other than the holder of a Novice Class license, as trustee for such society.

[*§ 97.39 amended eff. 12-1-72; VI(72)-1*]

(To be continued next month)

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I can understand why there may be some irritation over this at HQ. The League is supposed to provide leadership and to know the answers – and I hope I won't be accused of any exaggeration when I suggest that ARRL could have done a lot better in this. I understand that all repeater applications using the QST article on determining height above average terrain are being rejected by the FCC. I understand that the phone companies are very upset over the QST article on telephone remote control. That's two articles, and both bombs. But why take out your frustration on me? You need someone on the staff with repeater experience. Isn't it time to look around and get a staffer who can help QST get up to date on the largest single facet of our hobby today?

If there could be more positive thinking – trying to help rather than trying to bad mouth me and shoot me down – I think everyone would benefit. The reason that repeater groups turn to me is because ARRL has dropped the ball. If they could get answers from HQ they would.

Harry, as you know, I have offered verbally and in writing to work with the League in any way possible toward their goal of getting Mr. Walker transferred so the growing flood of restrictive and asinine (to use Lew McCoy's word) regulations will stop. I think it is important for all of us to work together in this if amateur radio is to ever get back on its feet – and I think you agree. Let's cut out the hatchet jobs and work together – *please*.

BRAINS TURN TO JELLY

An article in a recent issue of *Psychology Today* backed up something that I've always suspected; noise gradually turns your brains to jelly. This backs up my suspicision that the FCC is behind a plot to destroy amateur radio – it all fits in. Their recent ruling seems just to be insane – it made no sense at all – no one could figure out why the FCC had suddenly demanded continuous monitoring of repeaters. Now it begins to be clearer – this is part of the plot to turn the brains of repeater control ops to jelly and thus insure their early demise.

Look what rock music has done to the kids!

FCC EXAMINATIONS

Let's take a look at a recent monthly report on license exams given and see what sort of statistics are reaching the amateur division chief.

Okay, let's just look at those figures for a minute. Note that high percentage of General failures. The report goes on to show that about 60% of those taking the written General exam fail it. I'll bet they never read our study guide book!

The 37% overall failure is interesting. That means that over one third of those taking an exam fail it. If you think of that in terms of what it costs on the average for amateurs to get their license – at $9 per try – this comes to $14.31 each. When the price goes up soon to $10 that will assay out at $15.90 average.

Note that 18% failure rate for supervised Tech license exams. The report form shows that 435 mail exams were given for Tech and that 69 failed this – a failure rate of 16%.

	Total	Tech	General	Advanced	Extra
Supervised Exams	2691	337	1582	511	261
Passed	1692	277	838	371	206
Failed	999	60	744	140	55
% Failed	37%	18%	47%	27%	21%

Licenses by Classes

	Novice	Tech	Condit.	General	Advanced	Extra	Total	
3-66	14862	58825	39780	105149	38781	4523	261,920	
3-67	11866	58561	37597	106957	37379	4796	257,156	-4764
3-68	12778	57002	35988	108089	37804	5881	257,545	+ 389
3-69	15910	54675	33992	100064	45862	8405	258,908	+1363
3-70	22694	53666	32730	95394	50736	10014	265,234	+6226
3-71	23305	52876	31706	91980	54692	10998	265,559	+ 325
3-72	24118	52224	30726	89182	57283	11716	265,249	- 310
3-73	24052	51060	29198	85971	59288	12239	261,808	-3441

This would seem to put the lie to the theory propounded by Walker that a high percentage of the mail exams are passed fraudulently. Those percentages are almost exactly the same!

The amateur going for the Tech or the Extra has a pretty good chance of making it. The most difficult one is the General with the 47% failure. When you work out the cost of getting that license it comes to an average of $16.98 at the $9 fee and $18.87 when the price goes up to $10 per try. The fact is that it is going to cost about half of those trying $20, at least. Mounts up, doesn't it?

KC REPEATER SHUT DOWN

On my recent trip through the midwest I got the report that the main Kansas City machine had been shut down because the local FCC official was part of a small competing repeater group and forced the big one to shut down. It seems that some changes had been made since the October 17th deadline and thus the repeater was not exactly the same as before – and thus could not be grandfathered along until June 30th. The FCC strikes again! Why, oh why don't they devote even a small part of this persecution to the CB mess?

FCC RESPONSIBILITY

Since the FCC has taken over control of new ham rules and regulations – as witnessed by the punishment licensing deal in the 60's and the repeater licensing recently, it follows that the responsibility for the growth of the service is theirs too. Obviously it is the rules which govern, in the last analysis, the growth or death of the service.

Even a casual look at the graph of the number of amateurs over the last twenty years tells the story. Punishment licensing was proposed by the ARRL in 1963 – the FCC futzed around for four years – and look at the curve! Growth stopped short in 1963. Now do you really think that was a coincidence?

The Commission has done absolutely nothing whatever, after ten years of total stagnation, to get amateur radio into gear again. They have turned a deaf ear to amateur proposals for encouraging growth – and they have come up with nothing on their own. It is way past time for the Commission to face its responsibility and do something – or else change their basic policy and stop preventing amateurs from having a say in the thing.

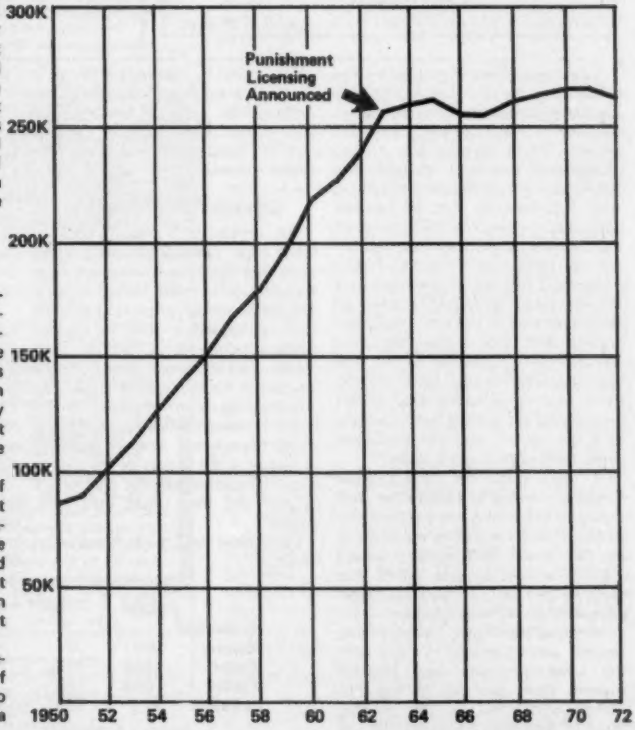
It is time that amateurs started making it known to the FCC that they are fed up with the situation – that new rules are needed which will encourage growth.

NEW CHANNEL 1 TELEVISION?

The broadcast magazines and newspapers have been reporting new FCC interest in channel 1 television – for educational stations. Ch 1 was originally 50–56 MHz back in 1941 and then changed to 44–50 MHz in 1945. No TV stations ever used the channel and it was reassigned to the land mobile services.

If they decide to reassign Ch 1 for ETV then they would have to move the land mobile users to higher frequencies. It is possible that they might decide that hams in between Ch 1 and Ch 2 would cause too much TVI and either kill the 6m band, make it smaller, or move it a bit.

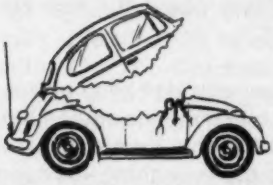
We are not in a strong position on this because we have far too few amateurs to keep this band active. It is unfortunate that attempts to open a new hobby class of amateur license have been so bitterly opposed by the League as this might have provided the new amateurs which could have occupied the 6m band. We do need a



lot of new amateurs and it would seem of first importance to figure out how we are going to get them. We don't need 10% more, we need 500% more.

RIPPED OFF RIGS

Several of the Dayton Hamventioneers who were staying at the Howard Johnson motel had their cars broken into and their rigs ripped out. In one case the burglars were not able to easily remove the rig so they chopped out the dashboard, rig and all, leaving a shambles. Maybe we should leave the rigs on the seat, ready to go?



Mr. Johnson shrugged his shoulders, when asked about his liability as hotel keeper. Those amateurs who had made peace with their insurance agents will probably be reimbursed to some extent. Obviously you have a lot to gain and nothing to lose if you get together with your agent before the rip off and make sure that you are actually insured – and that you will get enough to buy a new rig when yours is stolen. Find out about the equivocation before the fact instead of fuming at the agent afterward.

It doesn't hurt one bit to make a note somewhere of the serial numbers of the gear involved – and what can it cost you to write your name and address inside the case with a vibrator tool? As soon as you discover the tragedy notify the local fuzz and get that event into the record. You could do worse than send the serial numbers to 73 – a couple of rigs have been found this way so far – and if we work up a truly definitive list it will be used by everyone. As long as some send a note to QST – some to CQ and some to 73, there are too many places to look and it is all a waste of time. And note that 73 is the ONLY magazine that keeps the list going, month after month.

Another idea – the next time you hear a strange voice on the repeater – someone who obviously doesn't know what is what – instead of scaring him, why not get into a conversation with a buddy a little bit later over the repeater and mention that you are really in the market for another rig – have money at hand to pay for it – and give your phone number – you might catch a thief.

Once you have your insurance to protect you, you still have every reason to try to keep from being robbed. It does not do the car any good to have the wind wing bent backwards – the cloth roof slit – a window broken – things like that. And if you have to collect from ye insurance company you can bet that your premiums will soon be prohibitive – not to mention any deductible amounts.

Of course it is basic to make it a practice not to walk off and leave your car unlocked – that's giving your gear away – and perhaps the car too. Make every effort to lock your car even in lots where they want you to leave your keys – some of my worst losses have been in these lots – and they accept no responsibility when they clean out your car for you. Do they pay those boys low wages and let them make it up this way?

If you are going to park your car in high risk areas (like within 100 miles of Manhattan) it might be smart to plan ahead and make a fast removal installation of the rig so you can put it in the trunk when you leave your car – complete with the magnetic mount antenna – you don't need a flag up there saying looky here, bread for the taking. Cigarette lighter plugs work fine and allow the rig to be packed away in less than one minute.

Those power amplifiers can go under the seat out of sight since you don't have to reach it to use it anyway – or you can mount it in the trunk – under the hood – etc.

Car burglar alarms are okay too – particularly if you put in one that will notify you by radio when you have an unwelcome guest in your car. Lacking the money, energy, or interest to install one of these, you can sneak by with some burglars by buying a sticker that says you have an alarm. It can't hurt . . . unless a chap happens along who prefers a challenge in his work and is looking for a decal like that so he can express himself. Mostly it will turn off the run-of-the-mill crook.

MORE ROOM ON 20M?

Somehow I expect that the development of sideband is not quite the end of the line for amateur radio voice communications. True, we don't have anything really in the works right now – nothing with which amateurs are experimenting on the bands in the hopes of developing new techniques, but I will be surprised if a group doesn't come up with something soon.

Back soon after WW II we found a small group of amateurs experimenting with narrow band FM. I remember those early trials, led by Jack Babkes W2GDG in Brooklyn. At first he got special authorization from the FCC to try out the system – then, when it proved workable, the Commission opened segments of the bands for NBFM and Jack was in business with Sonar Radio making narrow band FM gear.

NBFM had some great advantages over AM – no big modulator and modulator power supply, for instance. But it had one enormous disadvantage – unless you had an FM detector on your receiver, AM would overpower the NBFM signal. And for some reason, though the circuit was extremely simple, the popular receivers never included this FM detector – so NBFM gradually died out. Pity.

In the very late 40's and early 50's another group of experimenters started work on sideband – single sideband. This was quickly grabbed up by Art Collins and sideband took over not only amateur radio, but the military too. Another system was being pioneered by G.E. at the same time – and it seemed to have some important benefits over SSB – but Collins had a lot more political savvy than G.E. and the double sideband system never got a good chance to prove itself.

Before you jump hastily to conclusions about two sidebands taking up more bandwidth than one, you should consider the importance of the synchronous detector – a little gadget which permitted signals with identical signals on both sidebands to come through, but kept out any which were not on both – with the result that you could copy a DSB signal right through a SSB signal – and could copy DSB signals only a few hundred cycles apart. It is possible that we could have a fraction of the QRM on our phone bands if we had gone the DSB route.

There are some techniques which hold promise for allowing less congestion on our phone bands. Some amateurs are beginning to work with digitalized voice systems. I don't know how narrow this would make a signal, but I suspect that it could get down to less than 1 kHz. That would help a lot.

Another possibility might be time diversity. I'm not sure what we would use for a standard clock to keep everyone in sync, but we know that it is possible to break voice up into small segments and send just a part of them and the result will sound normal. We could probably get five to ten stations on each frequency with this type of system.

There are undoubtedly other ways of going about this – any news from readers on this – or the above?

. . .Wayne

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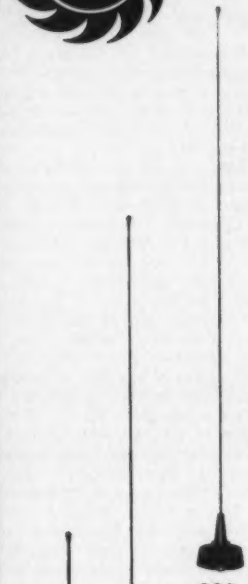

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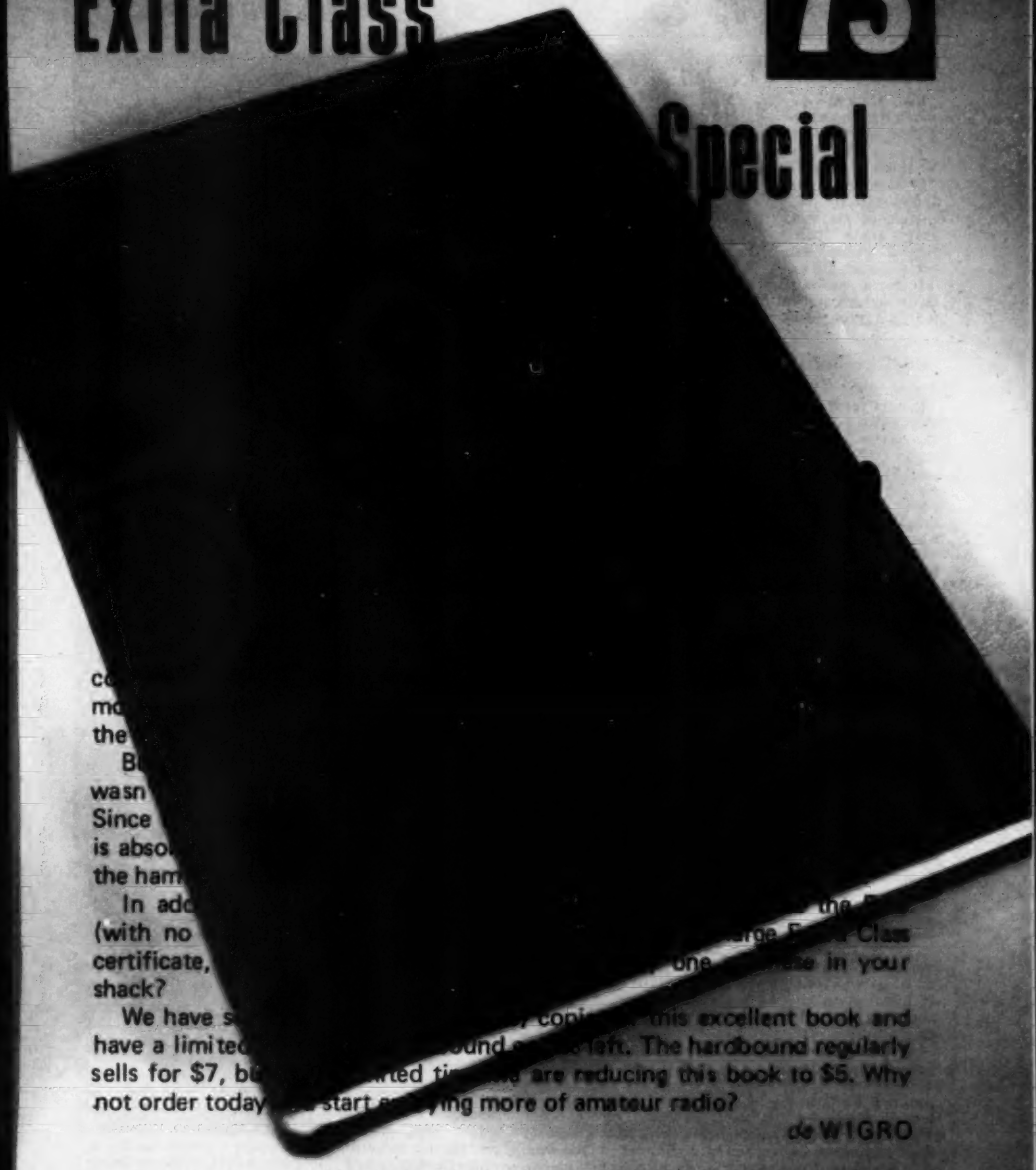

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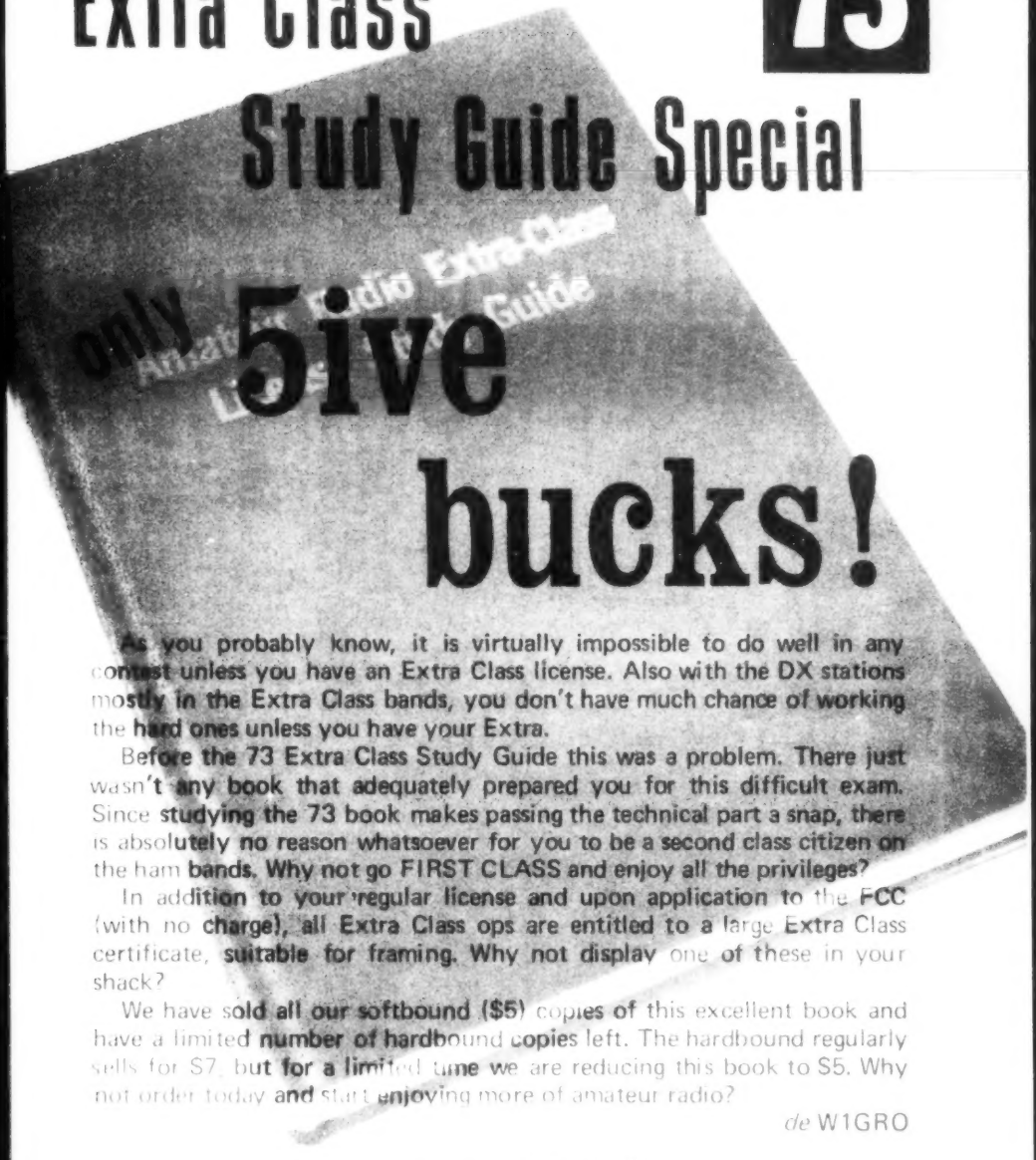

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SSTV-DXDC

Dress up the shack with this award for 2-way slow scan television communications with 10 countries. Endorsement provisions for separate bands. Dated and signed by Wayne Green, Editor and Publisher of 73 Magazine. Enclose postage for return of QSLs. 8½ x 11, light green color, dark green printing, $1.

RRCC Certificate

This Real Rag Chewers certificate is awarded only for the feat of a non-stop QSO for a period exceeding six hours with no time out for anything. Order must be accompanied with date/time (GMT) of start/end of contact, station contacted, and your call. Signed by Wayne Green. Light orange color, black printing $1

All Mode DXDC

How many can qualify for this one? An award for 2-way communications with 10 countries using CW-SSB-RITTY-SSTV modes. Certificate dated and signed by Wayne Green, Editor and Publisher of 73 Magazine. Enclose sufficient postage for return of QSLs. 8½ x 11, light red color, black printing, ...$1.

DXDC Certificate

Available for those who present proof of contact (copy of log) with 10 different countries. Awarding this certificate makes you a member of the DX Decade Club. Numbered and dated and personally signed by Wayne Green, Editor and Publisher of 73 Magazine. Printed on good paper, light purple color, black printing, 8½ x 11, suitable for framing..... $1.

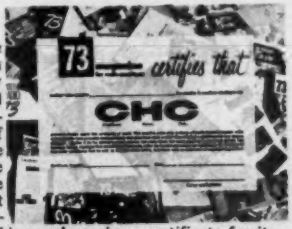
Understanding XYL/OM

An unusual certificate – get one and keep your mate happy. An award to those who have the good fortune of having an understanding partner who appreciates all good things about amateur radio (staying up all night, spending money for rigs, etc.). Sworn statement attesting to this must be submitted. 8½ x 11, light blue color, dark blue printing $1

RTTY-DXDC

Frame and hang this one above your machine. An operating award for those who have submitted proof of 2-way teletype communications with 10 countries. Endorsement provisions for different bands. Dated and signed by Wayne Green, Editor and Publisher of 73 Magazine. Enclose postage for return of QSLs. 8½ x 11, light blue color, black printing, ... $1

CHC Certificate



Presented to those who submit a sworn statement that they have never received a certificate for radio operating and if they ever receive one, they will hate it. This certificate should be your first before you accidentally do something and receive a certificate for it. This attests to your membership in the Certificate Haters Club. Light purple, black printing, 8½ x 11 .....$1

BOOKS & STUFF

73

Fascinating World of Radio Communications	$4.00
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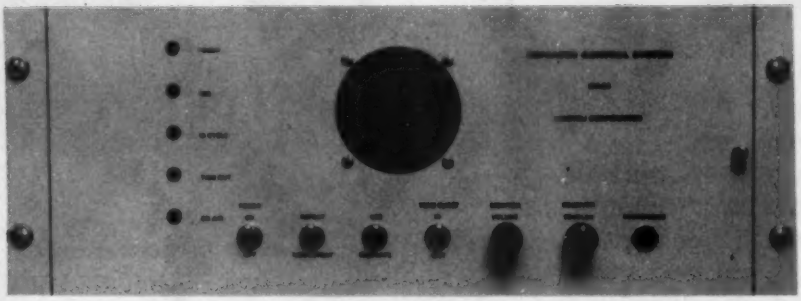
THE REPEATER PRINCIPLE



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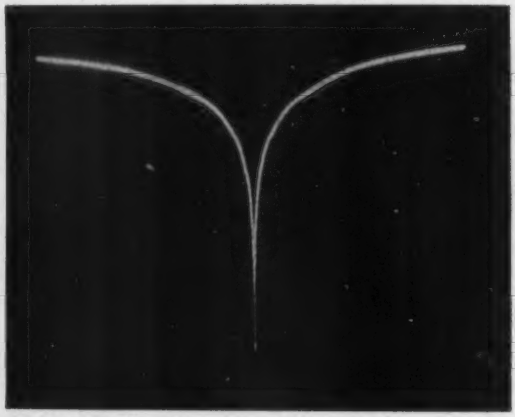

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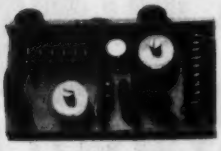

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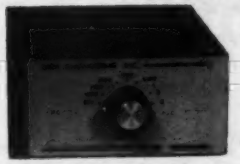

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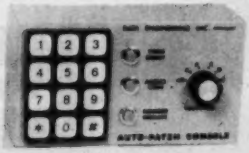

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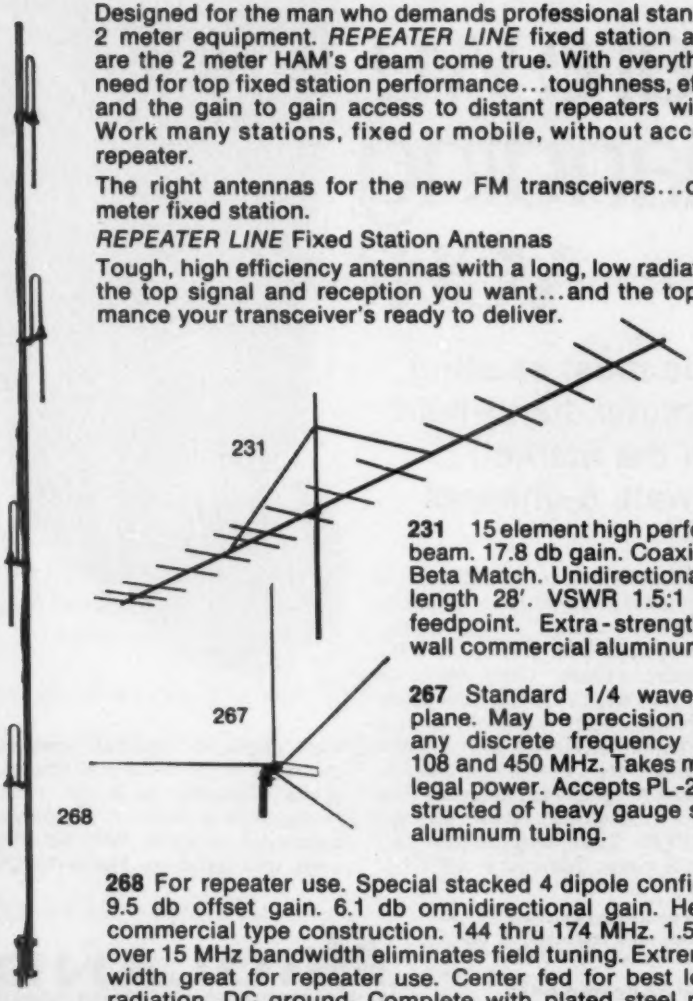

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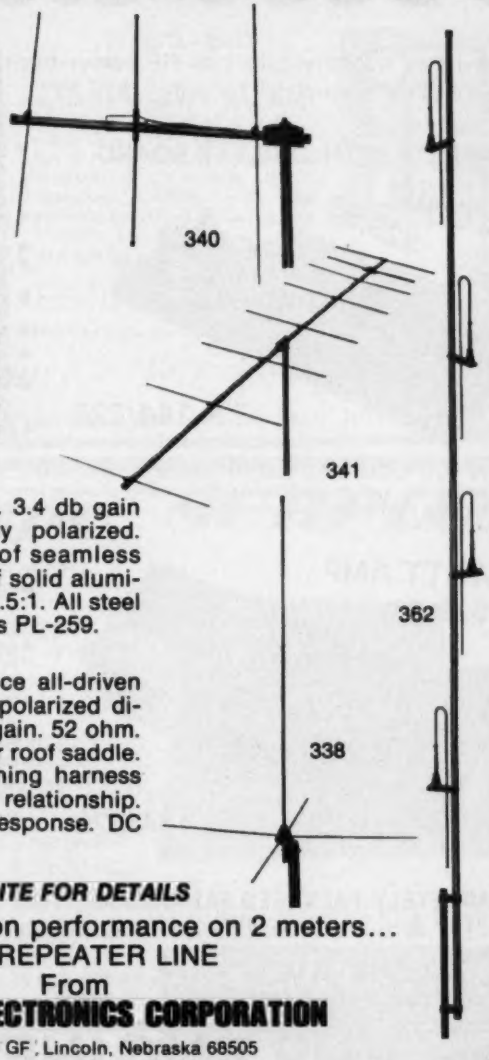

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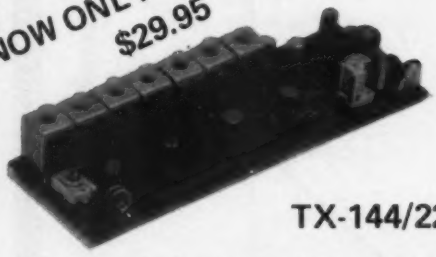

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15 WATT AMP
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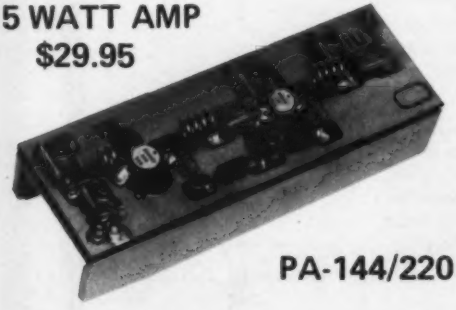

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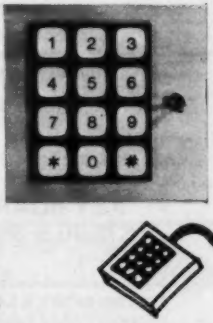

The "TESCO–PAD" has no tuned coils to go off frequency, no tuning necessary or even there! It's all in one "Black Box I.C." ready to go. The "TESCO–PAD" has a 1 second hold-up for your transmitter, complete P.T.T. operation, available with dual audio output levels, 12 or 16 tone combinations.

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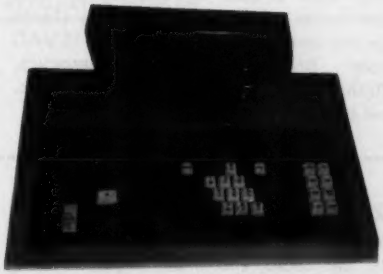

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147K stack 100.00

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Just right for powering car tape deck, CB sets, car radio, etc. from regular house current. We furnish parts – transformer, silicon bridge, filtering caps, directions. All new parts, order #KT-3 at $5.00 ea or 6 for $25.00

GIANT 7 SEGMENT

As above only this one is the giant display 13/16 inches hgt of character. First time offered and as far as we know, offered nowhere else. This one is quite an attention getter. Also available in this giant display numeral "one" with "plus" and "minus" sign. Again, these are rejects. Giant display $1.50 each 12 for $15.00

Meshna

Postage extra on above. **MESHNA PO Bx 62 E. Lynn Mass. 01904**

COMPUTER KEYBOARD W/ENCODER $35

Another shipment just received. Alpha-numerics keyboard excellent condition. Once again we expect an early sellout. Price of $35 includes prepaid shipment in the US and shipment made within 24 hours of receipt of order.

POWER TRANSFORMER

115ac/12V@3 amps . . . $2.50

POWER AMP TRANSFORMER

Brand new compact, regular 115 V 60 cycle input. Output of 40 VCT at 4 amps plus another winding 6V at 2.5 amps. Fine business for Power Amps, Logic or Op Amp supply.

$5.50 each or 5 for $25.00

12VCT 2A XFMR $1.50

Regular 115 volt 60 cycle input. 12 volt transformers are always in demand, these are brand new. **$1.50 each or 10 for $12.00**

60–SECOND TIMER

A bonanza for the photo lab or any requirement for a precision spring-wound timer. May be set at any interval 0–60 seconds. Contacts rated at 15 amps. Contacts close while running and open at end of time interval. Brand new.

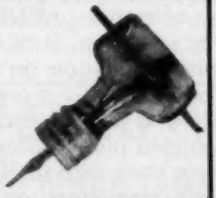
$1.50 each, 10 for $12

455 KC IF ASSEMBLY

Complete miniature 455kc IF. amp assembly. 1.5 inches long, little over ½ inch square. Ready to use w/schem. Sim to Miller 8902 . . . . . 2.50

RF VACUUM SWITCH

Made for the ART-13 good for 100 watts RF, no doubt handles much more due to being underrated for the military . . . #71-17 3/2.00



7400 SERIES IC GRAB BAG

Mix of 7400 series DIP, unmarked untested. Some schematics provided . . . . . 10 for 1.00
100 for 8.00
1000 for 60.00

IC SPECIAL – ONE MONTH ONLY

Our regular $15 IC board with approx. 140 DIP ICs on them, with ident sheet. For one month only we are pricing them at $6.50 per board to reduce our inventory. #IC-S **$6.50 0r 5 for $25**

COPPER CIRCUIT BOARD

Brand new GE 2-sided glass epoxy G-10, the standard of the industry, bright and shiny new. 6 x 12, $1.00. 12 x 12, $1.50.

AM-FM RADIO $5.50

Due to the West Coast ship strike they came in too late for the customer. Now it's your bargain. Use it as is or build it into your own cabinet, desk, wall, etc. All built, ready to use, with AC supply. To make it portable all you do is power it with a couple of "D" cells. Fully assembled solid state chassis with AC power supply, less speakers. Covers full AM as well as FM broadcast. The price. . .an astounding meager $5.50

PISTON CAPS 1-8 mmF 3 for $1.00

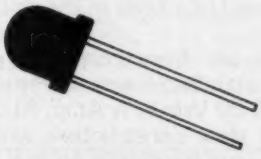
Unused Military surplus. For hi freq. work. List price over $3.00 each. We have 1 size only, 1–8 μF. No hardware.

#73-18 **3 for $1.00**

BATTERY ELIMINATOR–CHARGER

Plugs into 115 volt 60 cycle and puts out approx. 12 volts DC 100 mils. Sufficient to power most any small transistor radio and also useful for charging small dry cells and small ni-cad cells. Fully built, ready to use.

$1.00 each, 6 for $5.00



GIANT LED 83¢

Price break at last on these giant LED with 1,000,000 hours of life. Measure full 1/4 by 1/4 inch. First time offered.

RED $1.00
GREEN 1.25

SUPER BRIGHT collimated RED with parabolic reflector, measures 3/16 diameter. A real hi-intensity red visible over 100 ft.

SUPER RED $1.25

Meshna

Postage extra on above. **MESHNA PO Bx 62 E. Lynn Mass. 01904**

COMPUTER KEYBOARDS

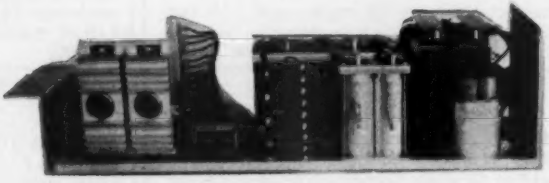
BRAND NEW

$50 postpaid

Just arrived, a superb batch of brand new keyboards still in original manufacturers cartons. Beautifully finished in pastel colors with contrasting colored keytops. Made for table operation with fully enclosed metal cabinet. Two encoder boards mounted inside the cabinet with connections terminating on Spectra flat cable with plug. Key operation with bounceless magnet reed switch action. These computer keyboards were dumped as surplus by one of America's largest electronic companies and we were lucky enough to be on the receiving end. The price of $50 includes prepaid insured shipment in the US and shipment same day as order received. Orders out of the US require an extra $2.00.

LOGIC POWER SUPPLY

$10



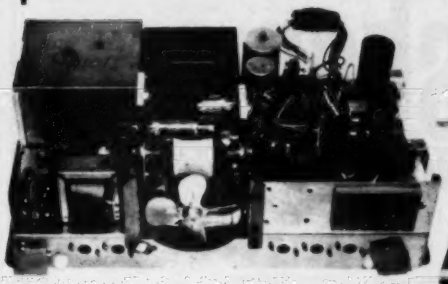
With 400 of these power supplies on hand, we figure we'd better sell them cheap and get them off the floor or all will collapse with a great crashing roar and land in a heap in the cellar.

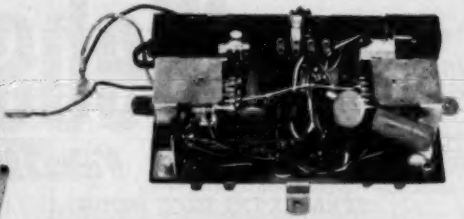
These are from computer power supplies, used, good condition. Operate from standard house current. 4 output voltages .... MINUS 30 Vdc at 1 Amp, PLUS 30 Vdc at ½ Amp, PLUS 10 Vdc at 1 Amp, MINUS 10 Vdc at ½ Amp. Solid state construction with harmonic regulation on the transformer and transistor regulation on the 10 volt outputs. This is one helluva bargain and worth buying just to scrap for parts (if you're crazy enough to tear it apart). You've got 2 transistorized zener regulated plug-in boards with sockets and by changing the zener you can regulate from zero to 25 volts, 2 husky filter caps (18,000 μf at 35 volts), power transistors on heat sinks, a nice transformer, and misc. other parts.

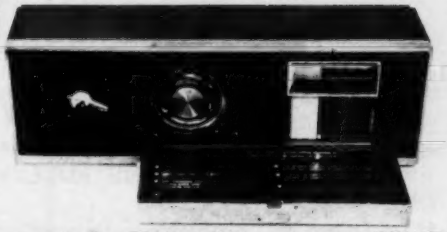
Ship. wgt. 37 lbs (you pay shipping) **$10.00 each or 3/$25.00**

Meshna

Postage extra on above. **MESHNA PO Bx 62 E. Lynn Mass. 01904**







PAY TV ASSEMBLY $15.00

A "Super Value" for the gadgeteer. A complete Pay TV installation made for ZENITH and all in original packing (3 cartons – wgt 36 lbs) and all unused. Operates on regular 115 volt 60 cycle power. A wealth of parts, easily removed due to long leads on components, most over one inch long. The 3 units consist of Translator, Adapter, Decoder. Transistors, tubes, solid state bridge power supply, geared clock motor, 35mm geared transport, time recorder, solenoid, relays, hundreds of small parts such as resistors, caps, etc. Our estimate as to cost to Zenith, approx $1,000 per set. Schematics with each purchase. One set of 3 units $15.00 wgt of 36 lbs. Special . . . 3 sets $35 wgt of 106 lbs. All unused, original boxed.

COOLING FAN BARRAGE $12.00

For the photo enthusiast, electronic industry, people cooler, etc. Brand new assembly made by HOWARD Industries, 3 fans per panel, 115 volt 60 cycle. Each fan good for 100 cfm and have blade guards both sides of each fan. To reverse flow of air, mount panel backwards. All brand new, ready to use. Silver gray panel finish. Standard 19 inch panel, 5 1/4 inches high. $12 per panel of 3 fans or 2 panels of 6 fans for only $20. Ship wgt 7 lbs per panel.

AM-FM STEREO RADIO $18.00 AS IS

THESE ARE FACTORY REJECTS TAKEN OFF THE LINE FOR REWORKING BUT THEN THE FACTORY CLOSED. We have UNUSED Solid State AM-FM radios with built in AC supply, extra outlets for tape, mike, or turntable. We furnish the schematic. These units made for console installation. Each with minor defects but we can furnish most any part found defective.

Meshna Postage extra on above. **MESHNA PO Bx 62 E. Lynn Mass. 01904**

Webster
radio

WHAT IS THE MOST IMPORTANT ITEM A DEALER CAN SUPPLY?

service

In addition to quality merchandise and fair prices Larry Webster offers **FREE SERVICE FOR ONE FULL YEAR ON ANY RIG YOU BUY DURING JUNE.**

If you have any problems with a rig you buy from Webster Radio send it back UPS collect. We will repair it and send it back to you prepaid via UPS for absolutely NO COST TO YOU. Naturally, this service guarantee is void if you have abused your rig.

Check out this month's specials at Webster Radio:

DUE TO FANTASTIC RESPONSE THIS OFFER IS BEING CONTINUED FOR ONE MORE MONTH!

146A
$289.00

826MA
$398.00

SB-144
$259.00

BUY NOW and receive your choice of 2 extra sets of crystals:

a Mosely MM144
or
a Ringo AR2

SB-450
$399.00

Most important of all, if you buy this month you get the free one year service on your rig. *We have many other great special values! Call now!*

BANKAMERICARD

2602 E. Ashland, Fresno, CA 93726
Call: (209) 224-5111
P.S. WE SHIP ANYWHERE IN THE USA FREE VIA UPS

master charge

CUSH–CRAFT 2M ANTENNAS!

IN STOCK . . . . SHIPPING PREPAID

AR-2 – **FM RINGO** – 3.75 DB Gain! – 135-175 MHZ – 100W Omnidirectional $12.50

AFM-6D – **4 POLE** – Up to 9 DB Gain! – All Hardware – 360° = 6 DB, 180° = 9 DB $42.50

AM-147 – **FM MOBILE** – 3 DB Gain! – Fiberglass – Roof or Trunk $26.95

A147-11 – **11 ELEMENT YAGIS** – 13.2 DB Gain! – Can be Vertically Polarized $17.95

A147-22 – **POWER PACKS** – 16 DB Gain! – Two A147-11's and Complete Stacking Kit . . . $49.50

A144-6 – **6 ELEMENT YAGIS** – 9 DB Gain! – 1KW – Mast or Tower Side Mount ..... $ 9.95

DX-120 – **20 ELEMENT DX–ARRAYS** – 14.2 DB Gain! – Combine the Best Yagi and Colinear Features – Can Be Stacked Up To 80 Elements – Dynamite for DX-ing and Moonbounce . . . $29.50

ASK FOR COMPLETE CUSH–CRAFT CATALOG . . . AMATEUR, COMMERCIAL, CB

Catalog Number	Any Quantity Per Item (Mix) 1-99	100-999	Multiples of 10 Per Item (Mix) 1000 up	100-990
7400	.34	.32	.30	.28
7401	.34	.32	.30	.28
7402	.34	.32	.30	.28
7403	.34	.32	.30	.28
7404	.36	.34	.32	.30
7405	.36	.34	.32	.30
7406	.56	.53	.50	.47
7407	.56	.53	.50	.47
7408	.38	.36	.34	.32
7409	.38	.36	.34	.32
7410	.34	.32	.30	.28
7411	.34	.32	.30	.28
7413	.60	.57	.54	.51
7416	.34	.51	.48	.45
7417	.34	.51	.48	.45
7418	.38	.36	.34	.32
7420	.34	.32	.30	.28
7421	.34	.32	.30	.28
7423	.84	.80	.76	.72
7425	.54	.51	.48	.45
7426	.40	.37	.34	.31
7430	.34	.32	.30	.28
7437	.56	.53	.50	.47
7438	.56	.53	.50	.47
7440	.34	.32	.30	.28
7441	1.73	1.64	1.55	1.46
7442	1.34	1.27	1.20	1.13
7443	1.34	1.27	1.20	1.13
7444	1.34	1.27	1.20	1.13
7445	1.71	1.62	1.53	1.44
7446	1.34	1.27	1.20	1.13
7447	1.30	1.23	1.16	1.09
7448	1.44	1.37	1.29	1.22
7450	.34	.32	.30	.28
7451	.34	.32	.30	.28
7453	.34	.32	.30	.28
7454	.34	.32	.30	.28
7459	.34	.32	.30	.28
7460	.34	.32	.30	.28
7470	.46	.43	.40	.37
7472	.40	.38	.36	.34
7473	.52	.49	.46	.43
7474	.52	.49	.46	.43
7475	.80	.76	.72	.68
7476	.58	.55	.52	.49
7480	.80	.76	.72	.68
7483	1.10	1.04	1.00	.95
7483	1.72	1.64	1.56	1.48
7485	1.38	1.31	1.44	1.37
7486	.60	.57	.54	.51
7490	.85	.80	.75	.70
7491	1.48	1.41	1.34	1.27
7492	.85	.80	.75	.70
7493	.85	.80	.75	.70
7494	1.32	1.26	1.20	1.14
7495	1.32	1.26	1.20	1.14
7496	1.32	1.26	1.20	1.14
74100	1.80	1.70	1.60	1.50
74104	.70	.67	.64	.61
74108	.70	.67	.64	.61
74107	.54	.51	.48	.45
74121	.60	.57	.54	.51
74122	.74	.71	.68	.65
74132	1.30	1.20	1.10	1.00
74141	1.75	1.66	1.57	1.48
74145	1.50	1.43	1.36	1.29
74150	2.00	1.85	1.70	1.55
74151	1.30	1.24	1.18	1.12
74153	1.70	1.60	1.50	1.40
74154	2.75	2.55	2.35	2.05
74155	1.56	1.49	1.42	1.35
74156	1.46	1.39	1.31	1.23
74157	1.56	1.48	1.39	1.31
74158	1.56	1.48	1.39	1.31
74160	2.30	2.10	2.00	1.90
74161	2.29	2.10	2.00	1.90
74162	2.29	2.10	2.00	1.90
74163	2.29	2.10	2.00	1.90
74164	2.29	2.10	2.00	1.90
74166	2.29	2.29	2.10	2.00

Catalog Number	Any Quantity Per Item (Mix) 1-99	100-999	Multiples of 10 Per Item (Mix) 1000 up	100-990
74175	2.00	1.90	1.80	1.70
74180	1.30	1.23	1.16	1.09
74181	5.20	4.90	4.60	4.30
74182	1.26	1.19	1.12	1.05
74192	2.10	2.00	1.90	1.80
74193	2.19	2.00	1.90	1.80
74198	3.10	2.95	2.80	2.65
74199	3.10	2.95	2.80	2.65

SCHOTTKY TTL

74S00	.88	.84	.79	.75
74S01	.88	.84	.79	.75
74S03	.88	.84	.79	.75
74S04	1.00	.95	.90	.85
74S05	1.00	.93	.90	.85
74S08	.88	.84	.79	.75
74S09	.88	.84	.79	.75
74S10	.88	.84	.79	.75
74S15	.88	.84	.79	.75
74S20	.88	.84	.79	.75
74S21	.88	.84	.79	.75
74S22	.88	.84	.79	.75
74S40	1.00	.95	.90	.85
74S50	.88	.84	.79	.75
74S51	.88	.84	.79	.75
74S60	.88	.84	.79	.75
74S64	.88	.84	.79	.75
74S65	.88	.84	.79	.75
74S72	1.82	1.73	1.63	1.54
74S74	1.82	1.73	1.63	1.54
74S107	1.82	1.73	1.63	1.54
74S112	1.82	1.73	1.63	1.54
74S114	1.82	1.73	1.63	1.54
74S140	1.00	.95	.90	.85

LINEAR IC'S

NE501A	2.99	2.82	2.66	2.49
NE536A	3.59	3.38	3.17	2.95
NE531V	3.81	3.58	3.36	3.14
NE536T	7.31	6.88	6.45	6.02
NE540T	2.40	2.25	2.10	1.95
SE540T	4.48	4.20	3.92	3.64
NE550A	1.30	1.23	1.16	1.09
NE555V	1.10	1.05	1.00	.95
NE556V	2.10	1.95	1.80	1.65
NE558V	1.00	.95	.90	.85
NE560B	3.57	3.36	3.15	2.94
NE561B	3.57	3.36	3.15	2.94
NE562B	3.57	3.36	3.15	2.94
NE565A	3.57	3.36	3.15	2.94
NE566V	3.57	3.36	3.15	2.94
NE567V	3.57	3.36	3.15	2.94
N5111A	.90	.86	.82	.78
N5595A	3.40	3.20	3.00	2.80
N5596A	1.87	1.77	1.66	1.56
709V	.50	.47	.44	.41
710A	.50	.47	.44	.41
711A	.55	.52	.49	.46
723A	1.00	.95	.90	.85
733A	1.90	1.80	1.70	1.60
741V	.55	.52	.49	.46
747A	1.10	1.04	.98	.92
748V	.60	.57	.54	.51
LM335	2.85	2.72	2.64	2.55
LM336	3.85	3.66	3.46	3.27
LM337	4.05	3.70	3.51	3.31

TRANSISTORS AND DIODES

1N270	.15	.14	.13	.12
1N914	.10	.09	.08	.07
1N4001	.10	.09	.08	.07
1N4002	.11	.10	.09	.08
1N4003	.13	.12	.11	.10
1N4006	.15	.14	.13	.12
1N747A - thru 1N758A	.25	.22	.19	.16
2N3860	.25	.23	.21	.19

All IC's are supplied in 8–, 14–, or 24–pin DIP (Dual-in-line) plastic or ceramic package except for NE536, NE540, and SE540 which come in TO–5 package. Voltage Regulators LM335, LM336 and LM337 are supplied in TO–3 (Diamond) package.

We give FREE data sheets upon request, so ask for those data sheets that you NEED, even for those listed IC's that you are not buying.

LED 7-SEGMENT DISPLAY:

Solid State Systems has now expanded it's line of LED Displays and also reduced their cost. The following are now available from us at these prices.

	1–49	50–99	100–499	500–999	1,000 up
SSS-1	4.50	4.25	3.75	3.40	3.00
SSS-1C	4.75	4.50	4.00	3.65	3.25
SSS-2	4.50	4.25	3.75	3.40	3.00
SSS-3	7.75	7.50	7.00	6.75	6.50
SSS-4	7.75	7.50	7.00	6.75	6.50
SSS-7	3.50	3.25	3.00	2.75	2.50
SSS-9	3.50	3.25	3.00	2.75	2.50
Minitronx*	3.00	2.75	2.50	2.25	1.90

The SSS-7 and SSS-9 are the common .33 in character height 7-Segment and overflow display respectively, with decimal point on the left and wide angle viewing. The SSS-1 and SSS-2 have the same physical dimensions as the SSS-7 and SSS-9 with increased life and slightly lower current requirement. The SSS-1C is the same as the SSS-1 except it has a colon instead of a decimal point, making it ideal for use in a digital clock. The SSS-3 and SSS-4 are the new giant .77 in character height 7-Segment and overflow display respectively, with decimal point on the right and readability up to 40 feet. *Also included above is a new reduced price on our Incandescent 7-Segment Display.

Package of 8, 1/4 watt current limiting resistors ..... $0.30.

MOLEX IC SOCKET PINS: Use these economical pins instead of soldering your IC's to PC boards. Sold in continuous strips in multiples of 100 pins only.

100 for $1.00	200 for $1.80	300 for $2.60	400 for $3.40
500 for $4.20	600 for $5.00	700 for $5.80	800 for $6.60
900 for $7.40	1000 for $8.20	each additional 1,000 $7.50	

Dual-in-line SOCKETS. Brand new with gold plated pins.

	1–49	50–99	100–499	500–999	1,000 up
14 Pin) Solder	.50	.45	.40	.35	.25
16 Pin) Solder	.55	.50	.45	.40	.30
14 Pin) Wire Wrap	.55	.50	.45	.40	.30
16 Pin) Wire Wrap	.60	.55	.50	.45	.35
14 Pin) Closed-Entry	.05	.05	.04	.04	.03
16 Pin) Closed-Entry Cup	.05	.05	.04	.04	.03

STANCOR TRANSFORMERS: Ideal for use with LM series.

P-8100, 25.2VCT, 1 amp $3.00
P-8134, 6.3VCT, 1.2 amp $2.75

HEAT SINKS: Wakefield series 680 circuit board coolers. 1¾" high with a dissipation up to 20 watts. Designed for use with TO–3 package.

	1–49	50–99	100–499	500–999	1000 up
Type 680–1.25A	1.20	1.10	1.00	.90	.80

ALLEN-BRADLEY MIL-GRADE (5-band) RESISTORS. Any of the 84 STANDARD 10% values from 2.7Ω to 220MΩ ¼ or ½ WATT. EACH ..... $0.05.

CERAMIC DISC CAPACITORS. Type SGA-1000WVDC:
5, 7.5, 10, 12, 15, 20, 22, 25, 27, 30, 33, 39, 50, 56, 68, 75, 82, 100, 120, 150, 180, 200, 220, 250, 270, 300, 330, 360, 390, 470, 500, 560, 680, 750, 820, 1000, 1200, 1500, 1800, 2000, 2200, 2500, 2700, 3000, 3300, 3900, 4700, 5000µµF.
EACH ..... $.10
0.01µF. EACH ..... $.11 0.02µF. EACH ..... $.12

LOW VOLTAGE DISCS, Type UK.
1.0µF, 3V ..... $.25 0.47µF, 3V ..... $.25 0.2µF, 10V ..... $.20
.1µF, 10V ..... $.12 2.2µF, 3V ..... $.30 0.01µF, 16V ..... $.10

ELECTROLYTIC CAPACITORS: All values are available in both, axial or upright (PC Board) mount. Please indicate your choice.

10µF, 15V ..... $.10	30µF, 35V ..... $.20	5µF, 50V ..... $.10
50µF, 15V ..... $.10	50µF, 35V ..... $.20	10µF, 50V ..... $.15
50µF, 15V ..... $.10	100µF, 35V ..... $.30	20µF, 50V ..... $.20
100µF, 15V ..... $.10	500µF, 35V ..... $.40	50µF, 50V ..... $.20
220µF, 15V ..... $.15	1000µF, 35V ..... $.50	100µF, 50V ..... $.30
500µF, 15V ..... $.20	1µF, 50V ..... $.10	200µF, 50V ..... $.40
1000µF, 15V ..... $.30	2µF, 50V ..... $.10	500µF, 50V ..... $.55
20µF, 25V ..... $.15	3µF, 50V ..... $.10	

TERMS: Rated firms NET 30 days. Otherwise check or money order with order. BankAmericard and Mastercharge are welcome. All invoicing is now done by computer therefore, the following standard charges will automatically be added to your order.

If your merchandise total is between:

			SPECIAL CHARGES		
$ 0.00 - $ 4.99	add	$1.00	COD	$1.00	additional
$ 5.00 - $24.99	add	$0.75	Air Mail	$0.50	additional
$ 25.00 - $49.99	add	$0.50	Postal Insurance	$0.25	additional
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3 amp hours, 1.2 volts, 6 oz. size = 1 7/8" x 1/2" x 6" military surplus—used good condition. Price **$2.25**

4 amp hours, 1.2 volts, 6 oz. size = 1 7/8" x 1/2" x 6" military surplus—used good condition. Price **$2.50**

6 amp hours, 1.2 volts, 11 oz. size = 4 1/2" x 2 5/8" x 3/4" military surplus—Unused. Price **$3.50**

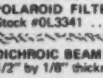
20 amp hours, 1.2 volts 2 1/8 lb. size = 3 1/8" x 1 1/16" x 8 1/4" military surplus—used good condition. Price **$5.95**

HOT PLATE, 115 Volts, 2000 watts, Dimensions: 8 1/2" diameter by 1 3/4" thickness. Stock #TS8012 ..... **$4.95**

QUARTZ REFLECTIVE HEATER, 400 watts, 110 volts. The unit is mounted in a large heat sink. Dimensions: 2" height, 3" width, length 14 1/2". Stock #TS8015 ..... **$4.95**

AIRCRAFT CAMERAS, TYPE K-17, with 9" x 9" format. COMPLETE WITH ASA MAGAZINE, 6" F.L. WIDE ANGLE
f/6 metragon, Stock #OL3321 ..... **$115.00**
24" F.L., f/6, Stock #OL3322 ..... **$125.00**
B3B Intervalometer, Stock #OL3323 .... **$20.00**

OPTICALLY PERFECT GLASS DOME, Built to stringent Government specs. for aircraft optical applications. Glass 3/16" thick, optically polished both surfaces. Metal rim has 18 mounting holes. Stock #OL3331 ..... **$45.00**



POLAROID FILTER, 6" diameter, laminated in glass, red in color. Stock #OL3341 ..... **$4.95**

DICHROIC BEAM SPLITTING MIRROR, 80% transmission, 4" by 6 1/2" by 1/8" thickness, Brand New Surplus. Stock #OL3343 .. **$4.95**

INFRARED IMAGE TUBE, Newer model. This is Farnsworth or RCA manufactured tube #6032. It is a later model than the 1P25. Potential should be approx. 20,000 V. (as compared to 5,000 for 1P25) Size is 4 1/2" long, 2" diameter at its widest point. Stock #OL3335 ..... **$12.50**

U.S. NAVY SIGNAL SHUTTER, Shutter is mounted behind 12" diameter plate glass. Wonderful novelty item for boat, beach house or den. Stock #MI7706 ..... **$6.95**

STEPPING SWITCH, 24 VDC, 20 ohm coil, 1.25 amp coil, 12 level 2 br'g, 10 non-br'g, 11 steps, contacts are Phosphor-Bronze, interrupter 1C off normal 2C. Dimen: overall length 4 1/2", width 2 3/4", depth 2 3/8". MFG. CLARE CORP. MODEL 211 Stock #RL9037 .... **$12.95**

WESTERN ELECTRIC AUTOMATIC STEPPING SWITCH, 12V.D.C. 3 level, 10 steps and off with second coil to reset. Stock #RL9038 .... **$12.50**

DEWAR FLASK, Thermos type Model #LLER 8642, 4300 m.l. Dimensions: L 13 1/4" by 6 3/4" dia. Stock #TD7507 ..... **$8.95**

MANOMETER, WELL TYPE, Made by Trimount Inst. Co. #2236 0 to 30 inch, 1/10 subdivisions. Can be used with oil mercury or water. Dimensions: L 3 1/4", H 44" x W 6 1/2". Stock #TD7508 ..... **$47.50**

OPTICAL PROVING RING, capacity 6000 lbs. Mfg. by Steel City Testing Machine Inc. Model PV123. Stock #TD7509 ..... **$195.00**

OPTICAL PROVING RING, capacity 120,000 lbs. Mfg. Steel City Testing Machine Inc. Model PV123. Stock #TD7510 ..... **$275.00**

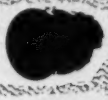
T30 MICROPHONE, Carbon type, 75 ohm 50 db below 1 mw, flat response with PL-291 2 contact male plug, 11" cord. Unused. Stock #MI7778 **$1.50**

HS-30 HEADSET, 250 ohm impedance — Hearing aid type, light weight headband 9" cord w/spade lugs that wire into CD-604 cord for 4000 ohm impedance. Unused. Stock #MI7779 ..... **$4.95**

ALTIMETER, SENSITIVE, Type MA-1, 0–80,000 feet. Manufactured by the Aerosonic Corp. Condition: used good. Stock #MI7781 ..... **$49.50**

HIGH PRESSURE TANK, Type A, Rated at 1800 PSI, 18" by 6 1/2", 1" pipe port at top of tank. Stock #ACT2106 ..... **$12.50**

LENS, Mfg. by Pacific Optical Corp. 24" focal length, f/4.0, 9x9 format, coated lens mounted completely with Iris and Shutter. Stock #MI7782 ..... **$150.00**



OXYGEN CONVERTER, Aircraft type rated at 70 PSI, 7 liter approx. capacity. Stainless steel body. Has 4 ports for inlet, outlet and gauges. Mfr. Aro Eq. Co. Measures 9 1/2" H by 13 1/2" dia. Stock #ACT2107 ..... **$49.50**

100 RPM, Mfg. Delco, 27 VDC PM reversible, governor controlled, overall dimensions: 4 1/2" long, 1 3/8" dia., 1/4" shaft. Stock #DCGM5012 ..... **$15.00**

OXYGEN CONVERTER, Converts liquid to gaseous oxygen. Aircraft type with stainless steel body. Dim: 8" H by 11" dia. 75 PSI, 5 liter capacity. Complete with regulator valve. Mfg. by Bendix. Stock #ACT2108 ..... **$49.50**

110 RPM, Mfg. G.E., 27 VDC 0.7 amps, 1 oz.ft. torque. Dimensions 3 7/8" long, 1 3/8" dia., 1/4" shaft. Stock #DCGM5013 ..... **$10.00**

120 RPM, Mfg. Delco, 27 VDC governor controlled, dimensions: 4 1/2" long, 1 3/8" diameter. Stock #DCGM5014. ..... **$15.00**

VICKERS HYDRAULIC MOTOR, displaces .095 cu.in. per revolution, delivers 2.5 GPM at 6000 RPM. Power is 4.5 HP output at 3000 PSI. Produces 45.5 in.lbs. of torque. Ports are 5/16" AN, internal spline is 3/8 inch - 6. Dimen: 2", x 2", x 4". Stock #PC4507 ..... **$99.50**

125 RPM, Mfg. Delco, 27 VDC PM governor controlled, reversible. Dimensions: 4 1/2" long, 1 3/8" diameter. Stock #DCGM5015 ..... **$15.00**

130 RPM, Mfg. Ostar, 28.5 VDC, shunt, 8,000 rpm .09 oz.in.right angled gear head, Dimensions: 4 1/4" long, 2" wide, shaft 1/4" threaded, by 1/2" long. Stock #DCGM5016 ..... **$6.50**

VICKERS HYDRAULIC MOTOR, displaces .060 cu.in. per revolution, delivers 1.7 GPM at 6060 RPM. Power is 3 HP output at 3000 PSI. Produces 31.1 in.lbs. of torque. Ports are 3/8" AN external, Spline is 13 tooth 7/16", Dimen: 2", x 2", x 4". Stock #PC4508 ..... **$95.00**

FR-5/U FREQ. METER 10 to 100 MC **$99.50**
FR-6/U FREQ. METER 100 to 500 MC **$99.50**
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TEK 105 Square Wave Gen. **$49.50**
TEK 110 Pulse Gen. **$75.00**
TEK 121 Wide Band Pre-Amp 5 CPS – 12 MHz **$35.00**
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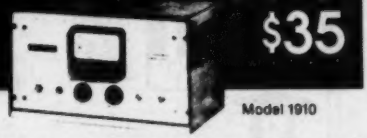
SHURE BROS. CM-16C (similar to Shure 488) hand held Dynamic Mike 200Ω New **$14.95**
AMERICAN ELECTRONICS LABS SNB 243A crystal switch 1-4.0 G.C. New **$14.95**
TV-7D/U Mutual Conductance tube checker **$19.95**
R-77/ARC3 Receiver (less xtals) **$9.95**
RT-178/ARC 27 225.0 to 339.9 MC Transmitter may be tone modulated at 1020 cycles per second for emergency or direction finder purposes **$50.00**

Inventory close-out

Variable voltage-regulated

DC Power Supply

$35



Model 1910

Brand new, made by Warner-Chilcott Laboratories Instrument Division. Delivers a dependable 60-400 VDC at 100 mA or 600 VDC at 30 mA, with output deviation of less than 1% for line variations from 105 to 125 V. Switch-selectable ranges of 0-600 VDC or 0-120 mA. Operates on 117 VAC ±10%, 50/60 Hz. 110 W. Size: 16" wide, 11" deep, 9¼" high. Designed for electrophoresis, but may be used wherever closely regulated DC is needed. Originally $380.00, now just $35.00 ea.

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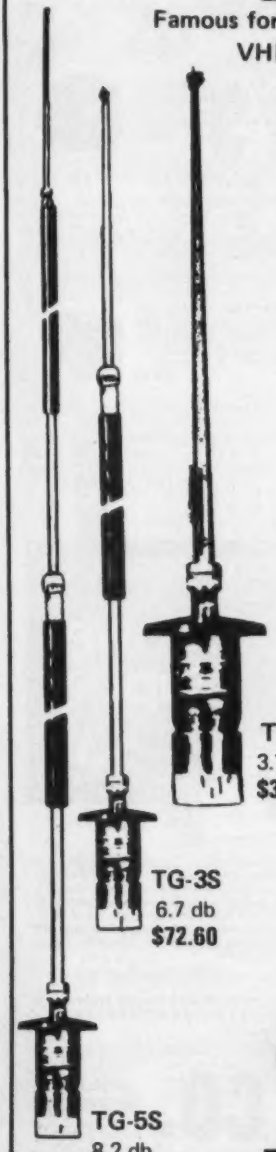
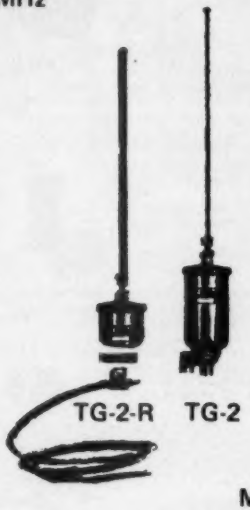


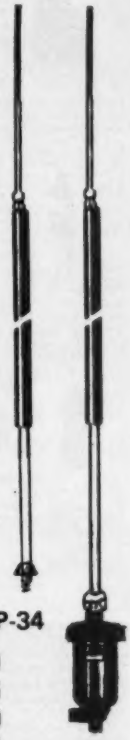
TG-3
3.7 db
$38.75

TG-3S
6.7 db
$72.60

TG-5S
8.2 db
$104.50



TG-2-R **TG-2**



MP-34

TG-4-MS

TG-2-R	3.7 db	List	**$33.00**
TG-2	3.7 db	List	**$22.05**
TG-4-MS	6.7 db	List	**$55.00**
MP-34	6.7 db	List	**$34.65**

14.9 db Omni-Directional Gain

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• Simple Conversion to 30 Watt Output

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REGULAR $246.90

OUR SPECIAL PACKAGE PRICE $199.95
Please add $10.00 Substituting HAMPAK for AC on GTX 10
Package With HAMPAK and AC - $232.00

GTX 200

100 channel combinations, features independent selection of transmit and receive frequencies, and switch for pre-selected pairing.

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(3) 2 Extra xtals your choice (stock list) $12.00
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Battery pack for GTX 10 portable operation. Uses 10 D cells (not included) $39.95

(includes portable antenna, carrying handle & mike clip)

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Marine/Master-25w

2-Way VHF-FM Marine Radio Telephone*

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(Weather monitor and channels 6 + 60)

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Optional Accessories:

- 3 dB, 6 dB, or 9 dB gain lay down gleaming white fiberglass antenna
- 3 dB sailboat antenna, mounting hardware and 60' of marine white cable
- channels 68, 26, 28, 12

PLEASE WRITE FOR OUR SPECIAL PACKAGE PRICES!

★ FLASH ★ FLASH ★ FLASH ★

Look at what you get for NO REPEAT NO EXTRA CHARGE. The GTX-2 and GTX 200 have a super sensitive Dual Gate Mos Fet pre amplifier BUILT IN the receiver front end for superb, less than .25 microvolt sensitivity. THE BEST receiver now even better!

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Alpha-70 PA 70V vapor cooled linear, brand new cond.	1,275.00	895.00
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TX-62 & 2 meter xmitter w/621 VFO, Dow Relay	149.00	95.00
TX-62 & 2 meter xmitter	99.00	69.00
BIRD		
43 wattmeters (new) limited quantity		85.00
COLLINS		
620T VHF conv.	595.00	495.00
KWM-1 xcvr w/516F-1 AC and 312 B-3 (same as 312B-4, perch, SWR, etc.) latest, new cond.	495.00	395.00
CLEGG		
99-er 6m xcvr working, as is	59.00	29.00
Thor 6 xcvr w/AC mod	169.00	99.00
FM 27A FM xcvr, like new	338.00	269.00
DRAKE		
2B rcvr, 28Q "Q" mult/spk	210.00	179.00
2A rcvr, 2AQ "Q" mult/spk and cal.	189.00	149.00
MN-2000 matching network	159.00	139.00
T4X B w/cur.tom AC/spk by Drake, new cond, in carton	489.00	389.00
SW4A gen. cov. rcvr., new cond.	229.00	199.00
GALAXY		
FM 210/AC FM 210 amp, 6 xtals, mic.	189.00	125.00
GLADDING		
Gladding 25 w/xtals 34/76, 94/94, 94/94, 22/82, 28/88, and 16T	195.00	159.00

	Reg.	Our Price
GONSET		
6m Comm IV	119.00	69.00
HALLICRAFTERS		
SX-111 rcvr latest w/prod. dect.	129.00	99.00
SR-150 xcvr w/AC/spk	350.00	249.00
SX-146 rcvr, R-50 spk, HA-19 cal, (excaves w/HT-46)	195.00	169.00
SR-42A 2m xcvr, new cond, w/2 xtals	149.00	119.00
SR-46A 6m xcvr new cond. w/4 xtals	189.00	89.00
HA-26 & 2 VFO	39.00	29.00
HEATH		
HX-10 Marauder, 180 watt SSB-AM xmitter	189.00	119.00
HW-16 CW xcvr, 80, 40, 15	99.00	79.00
HG-10 VFO 80-2 meters	39.00	29.00
SB-110A 6m SSB xcvr w/SB-600 2m transverter & HP-23A/AC like new, checked by Heath	430.00	329.00
SB-500 2m transverter	129.00	89.00
HD-1 "D" mult w/built in AC ps.		10.00
SB-A-300-3 6m Conv.		8.00
KNIGHT/ALLIED		
TR-108 15 watt 2m xcvr w/AC, DC, mic, like new	99.00	79.00
AX-190 ham rcvr, 80-10 + WWV, 1 KC. cal, etc.	199.00	149.00
MAGNUM		
Magnum 6 RF speech processor for Kenwood T-599, brand new, warranty	139.95	99.00

	Reg.	Our Price
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NCX-5 conv. to MK-2 w/NCX-A AC/spk, 100Kc cal.	429.00	325.00
NC-155 rcvr	119.00	69.00
NCX-5 MK II w/NCX-A AC/spk, 100Kc cal.	450.00	379.00
SWAN		
SW-240 w/117B AC/ps brand new cond.	229.00	179.00
280C 6m xcvr w/117XC AC/spk, VOX, NS-1 noise silencer, new cond.	430.00	389.00
117X basic AC	65.00	39.00
TPL/TEMPO		
502 5-15/35-55 watt output 2m amp, new	105.00	79.00
5028 1-3/45-90 watt output 2m amp, new	130.00	99.00
L-fr 1500 Dummy load wattmeter, new	119.00	79.00
TC-102 24 hr. Digital clock, new	99.00	59.00
TEST EQUIPMENT		
Eico 378 Lab audio gen., like new	99.00	39.00
Clemmons SB-838 sig. gen. like new	295.00	225.00
RCA WV-98C Senior VTVM, new	99.00	59.00
Heath IOW-102 solid state scope, new	189.00	129.00
Winslow megohm meter (megger)	150.00	69.00
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MIIDA #5108 10Hz to 550MHz freq counter, new	960.00	725.00
MIIDA precision calculators	89.00 + UP	

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15W min
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450 MC
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25W 12 ch
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826MA
12 ch 10 watts
~~$398.00~~
$350.00

SCARPT-1A
2 meter RPT
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SRC14
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base unit
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- **Mobile**
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6CX8 Final Amp.
6AQ5 Modulator
12AX7 Speech Amp.

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The *NEW* **Excello CW Novice Transmitter** is *THE ANSWER* to the New Amateur getting on the air and enjoying the *GREATEST OF ALL* hobbies!

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1-40 Meter Coil
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PHILADELPHIA, PA. 19124

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AREA CODE 215
PI3-3663

CAPACITORS – MICA

MFD	VOLTS	SIZE	PRICE
.000051	6KV	01	$2.95
.00018	6KV	01	3.95
.0002	6KV	01	3.95
.00039	6KV	01	4.50
.0005	6KV	01	4.50
.00075	6KV	01	4.50
.0039	6KV	01	9.50
.00051	10KV	02	8.50
.00015	20KV	03	19.95

.001 mfd 25KV 18 Amp @ 1 mc.
1 Ceramic terminal
6½"x 6"x 4" footed.....$24.95

CAPACITORS – OIL FILLED

.2 mfd 50 KVDC
GE 14F126

1 Porcelain terminal
13" x 13½" x 5¼" $49.95

.25 mfd 20 KVDC
AEROVOX

2 Porcelain terminals
8" x 11" x 4" $19.50

1 mfd 10 KVDC Westinghouse

2 Porcelain terminals
8" x 9" x 4" $19.50

4 mfd 2000 VDC CP70E1EJ405K
2 Porcelain terminals
3 3/4" x 5" x 2½" $3.50

.5 mfd 1500 VDC CP70B1EH504K
2 Rubber terminals
1 3/4" x 2 3/4" x 1" ..... $.75

1 mfd 1000 VDC Aerovox 1009D
2 Porcelain terminals
1 3/4" x 2 1/8" x 1 1/8" . $.90

8 mfd 600 VDC GE 23F1014
2 Rubber terminals
3 5/8" x 3½" x 1¼" $1.55

7.5 mfd 236 VAC Sprague Clorinol
2 Bakelite terminals
2" x 2 3/4" x 1½" ..... $.95

METALLIZED BATHTUB CAPACITORS

AEROVOX P30ZN

4 mfd 150 VDC
2 Side terminals
1" x 1 3/4" x 3/4" $1.25

10 mfd 150 VDC
2 Side terminals
2" x 1 3/4" x 3/4" $2.45

MINIATURE CERAMIC DISC TRIMMER

ERIE #538-011A-5.5-18
5.5 to 18mmf. Printed circuit mount.....75¢ ea.
10 for $7.00 100 for $50.00

TRIMMER CAPACITOR

8 to 50 mmf N750
ERIE #557-000E-8-50 ..... $.39

E. F. JOHNSON Air Variable Capacitors

Sub Minature P C Mount
Single Section

TYPE U

Type	Min	Max	Plates	Price
189-2-5	1.3	5.4	6	.30
189-4-5	1.5	9.1	10	.30
189-6-5	1.8	13.0	14	.35

TYPE V

Type	Min	Max	Plates	Price
193-4-5	1.4	13.0	8	.35
193-6-5	1.7	20.0	12	.35
193-8-5	2.0	27.0	16	.40

FEED-THRU CAPACITOR

1000 mfd 500 VDC
ERIE #327-005-X5U0-102M... $.69

ELECTROLYTIC TUBULAR CONDENSERS

MFD	VDC	TYPE	PRICE
10	150	TVA 1406	.25
20	150	TVA 1410	.33
50	50	TVA 1308	.27
100	12	TVA 1130	.27
200	450	CD-BR	1.21
500	25	Nichicon	.33
1000	15	Callins	.35
4000	15	CD-BR	.75

10 TURN PRECISION POTS REMOVED FROM EQUIPMENT WIRES ATTACHED CHECKED & GUARANTEED

OHMS	MFR & TYPE	LIN
5000	HELIPOT MODEL A	.5%
10K	HELIPOT MODEL A	.5%
30K	HELIPOT MODEL A	.5%
50K	HELIPOT MODEL A	.25%
100K	HELIPOT MODEL A	.25%

YOUR CHOICE $4.00 ea.
4 for $15.00

HELIPOT DUODIAL

10 turn counting dial aluminum finish, black knob, with brake .....$3.95 ea.

Miniature 10 Turn Pot

10K .5% lin. Spectrol 570
Bushing mount. 3/8" shaft 1/8"dia.
Removed from equip.....$2.95

General Radio Type 214A
Potentiometer
10 ohms 10 watts 1A 3"dia.
¼" shaft.....$1.50

General Radio Type 973-F
Potentiometer
50 ohms 8 watts 1 3/4" dia.
3/8" shaft 1" long.....$1.50

1000 ohm 25 watt Rheostat
2 terminal metal enclosed
3/8 bushing ¼" shaft. 3 for $1.00

METAL CABINET RACK

Dim: 21" x 13" x 8 3/4"
Accepts 19" x 7" panel.
Has hinged top for easy servicing. Similar to Bud CR-1726. New.....$6.95

COMPUTER GRADE ELECTROLYTIC CAPACITORS

MFD	VOLTS	MFR	PRICE EA
500	200	GEN. INSTR.	$1.00
1500	40	SPRAGUE-36D	.75
2400	25	G.E.-43F	.75
2500	200	MALLORY	1.50
5000	40	SPRAGUE-36D	1.25
19,000	25	G.E.-43F	2.00

INTEGRATED CIRCUIT SOCKET

AUGAT 314-AG1A 14 PIN DUAL IN LINE high profile .375 h. diallyl phthalate body meets mil M-14
35ea. 100 for$27.50

SEMICONDUCTORS

1N3209 Silicon Rectifier
100PRV 15A.....$.60
1N3210 Silicon Rectifier
200PRV 15A.....$.90
2N2082 High Power Transistor
15A TD-36 case...$1.20
Two 2N2082 Transistors mounted on heat sink.....$2.25

SINGLE PHASE FULL WAVE BRIDGE RECTIFIER

Mototola MDA 962-4
10 amp 300V
.....$3.95 ea.
10 for $35.00

POWER TRANSFORMER WITH COMBINATION FILAMENT WINDING

STANCOR P-6011 115 VAC 60cy input
Secondary: 350-0-350VAC 70ma
5.0 VAC 3.0Amps C.T.
6.3 VAC 2.5 Amps C.T.
Mtg centers 2 7/8" x 3 3/8"
SPECIAL.....$1.95 ea.

STEP UP TRANSFORMER 292-5653P1

PRI: 110/115/120 VAC
SEC: 240/270 VAC @ 650 MA
Sealed 4 5/8" x 4" x 5".....$2.95

COAX CONNECTORS

PL259	(83-1SP).....	.35
SO239	(83-1R).....	.29
M359	(83-1AP).....	.98
M358	(83-1T).....	1.49
PL258	(83-1J).....	.79
UG175/U	(for RG58/U).....	.15
UG176/U	(for RG59/U).....	.15
CH239	Single hole mount.. SO-239.....	.75
5804	Single hole mount.. SO-239 with ¼" demounting.....	1.15
DM	UHF Double male....	1.10

ADAPTERS

BNC Female to UHF male.....	1.50
BNC Male to UHF female.....	2.50
BNC Female to N male.....	1.85
BNC Male to N female.....	3.20
BNC female to BNC female.....	1.40
BNC "T" 3 females.....	4.60
BNC "T" 2 females 1 male.....	2.60
BNC Rt. angle male-female....	2.00

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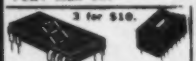
By RCA or equal 2N3632. NPN, 23 watts, 3 amps, TO-60 case, with stud mtg. VCEV max 65.



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0-9 plus letters.

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☐ Socket for above, 50c

☐ $1 each

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☐ 115/1/60 in to 12VCT

☐ 115/1/60 in to 24VCT

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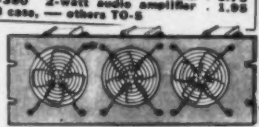
☐ Only **$12.00** 2 for $20



Tri "prop" fans on a silver-gray relay rack panel (19"). Excellent for your "rig", darkroom or any type of electronic work. Even ideal for hobby projects. 200 CFM per 4" fan. Each fan has 5" close mesh guard on each side of fan. Easily reversible. 3000 rpm motor, has hp of 1/50. Operates on 115/1/60 cycles. Wt. 7 lbs. By Howard Industries.

$1.98

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3 for $4.50

Removed from new equipment! Includes popular 2N174 'doorknob' transistor TO-36, germanium, PNP, 150 watts, VCEO 80V, 15 amps, 40 hfe. For ignition, high power transmitters, etc. Mounted on heat sink 5 x 2 1/2 x 1 1/4".

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Pin-for-pin subsitute for famous MAN-1. Electrically the same. Snaps into 14-pin DIP socket. Requires same drivers, i.e., SN7446 or SN7447. Requires 5V @ 20 mils per segment. 0.30 size character with left decimal. Size: 3/4 x 7/16 x 3/16".

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LED

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SN7405	.32
SN7406	.55
SN7407	.55
SN7408	.35
SN7409	.35
SN7410	.30
SN7411	.35
SN7413	.95
SN7416	.55
SN7419	.55
SN7417	.55
SN7420	.30
SN7421	.35
SN7422	.35
SN7426	.37
SN7430	.30
SN7432	.50
SN7437	.60
SN7438	.60
SN7440	.30
SN7441	1.40
SN7442	1.25
SN7443	1.35
SN7444	1.35
SN7445	1.35
SN7446	1.65
SN7447	1.65
SN7448	1.50
SN7480	.35
SN7481	.35
SN7483	.35
SN7484	.50
SN7485	.35
SN7460	.35
SN7464	.50
SN7465	.50
SN7470	.50
SN7472	.50
SN7473	.65
SN7474	.65
SN7475	1.30
SN7476	.75
SN7478	.95
SN7480	.75
SN7481	1.50
SN7482	.95
SN7483	1.50
SN7485	1.41
SN7486	.55
SN7489	3.75
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SN7491	1.50
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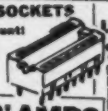

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711C Dual diff. comp (A)	.44
723C Voltage regulator (A)	.98
741C Frequency compensator 709 (A)	.49
741CV Freq. comp 709 (Mini DIP)	.49
747C Dual 741C (A)	1.25
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748CV Freq. adj. 741C (mini DIP)	.49
709-709 Dual 709C (DIP)	1.00
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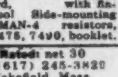

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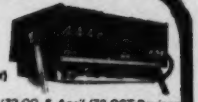

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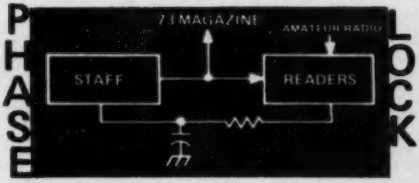

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SUN	MON	TUES	WED	THUR	FRI	SAT
(1)	(2)	[3]	4	5	6	7
8	(9)	[10]	[11]	[12]	[13]	[14]
15	16	17	18	19	20	21
22	[23]	24	25	26	(27)	(28)
[29]	(30)	(31)				

Possible aurora 28, 30.

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7	7	7	7	7	7	7	7A	7A	14
ARGENTINA	14	14	14	7A	7	7	14	14	14	14	14A	14A
AUSTRALIA	14	14	7A	7B	7	7	7	7	7	7	14	14
CANAL ZONE	14	14	7A	7	7	7	7A	14	14	14	14	14A
ENGLAND	7A	7A	7	7	7	7A	14	14A	14A	14	14	14
HAWAII	14	14	7A	7	7	7	7	7	7A	14	14	14
INDIA	7A	7	7B	7B	7B	7B	7A	14	14	14	14	14
JAPAN	14	14	7A	7	7	7	7	7	7	7	7	14
MEXICO	14	14	7	7	7	7	7	14	14	14	14	14
PHILIPPINES	14	14	7B	7B	7B	7B	7B	7	7	7	7A	7A
PUERTO RICO	14	7A	7	7	7	7	7	7	14	14	14	14
SOUTH AFRICA	7B	7	3A	7	7B	14	14	14	14	14	7B	7B
U. S. S. R.	7	7	7	7	7	7	7A	14	14	14	14	14
WEST COAST	14	14	7	7	7	7	7	7A	14	14	14	14

CENTRAL UNITED STATES TO:

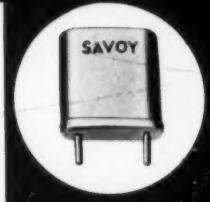
ALASKA	14	14	7A	7	7	7	7	7	7A	14	14	
ARGENTINA	14	14	14	7A	7	7	7A	14	14	14	14A	14
AUSTRALIA	14	14	14	7	7	7	7	7	7	7	14	14
CANAL ZONE	14A	14	7A	7	7	7	7A	28	28	28	28	28A
ENGLAND	7A	7	7	7	7	7	7	14	14	14	14	14
HAWAII	14	14	14	7A	7	7	7	7	7A	14	14	14
INDIA	14	14	7B	7B	7B	7B	7	7	14	14	14	14
JAPAN	14	14	14	7	7	7	7	7	7	7	7A	14
MEXICO	14	14	7	7	7	7	7	7	7	7A	14	14
PHILIPPINES	14	14	14	7B	7B	7B	7	7	7	7	7A	7A
PUERTO RICO	14	14	7	7	7	7	7	14	14	14	14	14
SOUTH AFRICA	7B	7	3A	7	7B	7B	14	14	14	14	7B	7B
U. S. S. R.	7	7	7	7	7	7	7	7	14	14	14	7

WESTERN UNITED STATES TO:

ALASKA	14	14	14	7	7	7	7	7	7	7	7	7A
ARGENTINA	14A	14	14	7A	7	7	7	14	14	14	14	14A
AUSTRALIA	14	14A	21	14	7A	7	7	7	7	7	14	14
CANAL ZONE	14	14	7A	7	7	7	7	14	14	14	14	14
ENGLAND	7A	7	7	7	7	7	7	7A	14	14	14	14
HAWAII	14	14	14A	14	14	7A	7	7	7A	14	14	14
INDIA	14	14	14	7B	7B	7B	7B	14	14	14	14	14
JAPAN	14	14	14	14	7	7	7	7	7	7	14	14
MEXICO	14	14	7A	7	7	7	7	7A	14	14	14	14
PHILIPPINES	14	14	14	14	7B	7B	7	7	7	14	14	14
PUERTO RICO	14	14	7A	7	7	7	7	7A	14	14	14	14
SOUTH AFRICA	7B	7B	3A	7	7B	7B	7B	14	14	14	7B	7B
U. S. S. R.	7	7	7	7	7	7	7	7	14	14	14	14
EAST COAST	14	14	7	7	7	7	7	7A	14	14	14	14

A = Next higher frequency may be useful also.
B = Difficult circuit this period.

Savoy



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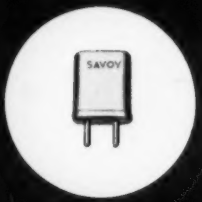
TYPE 900 A TYPE 901



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